GLA Energy Comments – Response Appendices

9,11 & 19 Osiers Road, Wandsworth, London

Prepared by: Stroma Built Environment Ltd

On behalf of: Hollybrook Limited *August 2019*

Introduction

The following appendix document accompanies a detailed response to comments by the GLA energy team, to the design proposals for 9,11 & 19 Osiers Road, Wandsworth, London

Appendix A

Domestic Overheating Checklist

Domestic Overheating Checklist

This checklist is intended to assist designers to identify potential overheating risk in residential accommodation early on in the design process and trigger the incorporation of passive measures within the building envelope and services design to mitigate overheating and reduce cooling demand in line with London Plan policy 5.9.

Section 1 of the checklist should be completed at the start of the design process (concept design) and should be submitted with the preliminary energy information provided to GLA at pre-app stage. Section 1 and 2 should be reviewed as the design progresses and the full checklist should be completed and included within the energy assessment submitted at stage 1 of the planning application.

Section 1 - Site features affecting vulnerability to overheating		Yes or No
Site location	Urban – within central London[29] or in a high density conurbation	Y
	Peri-urban – on the suburban fringes of London[30]	N
Air quality and/or Noise sensitivity – are any of the following in the vicinity of buildings?	Busy roads / A roads	N
	Railways / Overground / DLR	Y
	Airport / Flight path	N
	Industrial uses / waste facility	N
Proposed building use	Will any buildings be occupied by vulnerable people (e.g. elderly, disabled, young children)?	Y
	Are residents likely to be at home during the day (e.g. students)?	Y
Dwelling aspect	Are there any single aspect units?	Y
Glazing ratio	Is the glazing ratio (glazing: internal floor area) greater than 25%?	N
	If yes, is this to allow acceptable levels of daylighting?	
Security - Are there any security issues that could limit opening of windows for ventilation?	Single storey ground floor units	N
	Vulnerable areas identified by the Police Architectural Liaison Officer	N
	Other	N

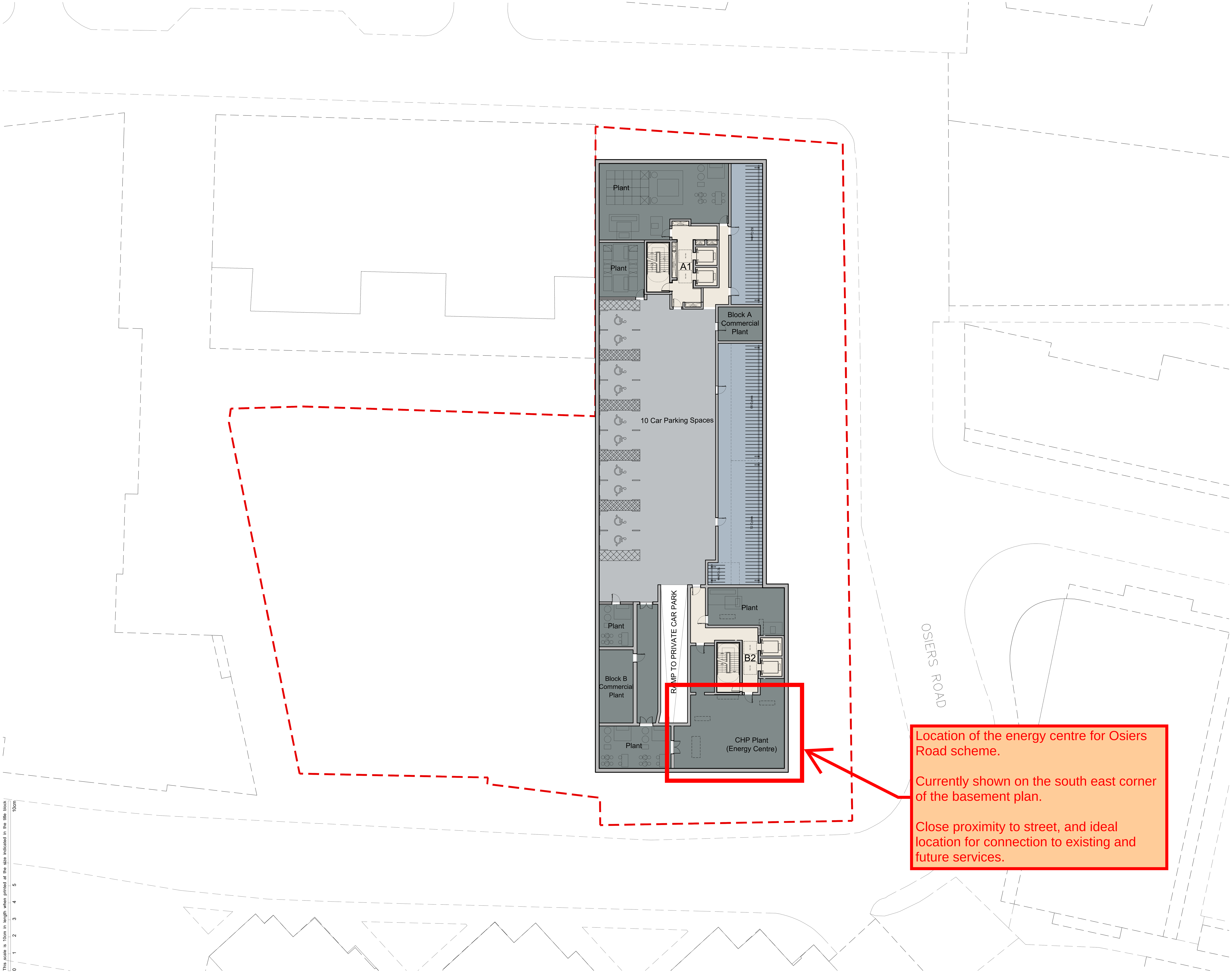
[29] Urban - as defined in CIBSE Guide TM49. Broadly equivalent to Central Activities Zone and Inner London areas in Map 2.2 of the London Plan
[30] Peri-urban – as defined in CIBSE Guise TM49. Broadly equivalent to Outer London areas in Map 2.2 of the London Plan

Section 2 - Design features implemented to mitigate overheating risk		Please respond
Landscaping	Will deciduous trees be provided for summer shading (to windows and pedestrian routes)?	Y
	Will green roofs be provided?	Y
	Will other green or blue infrastructure be provided around buildings for evaporative cooling?	Y
Materials	Have high albedo (light colour) materials been specified?	Y
Dwelling aspect	% of total units that are single aspect	16%
	% single aspect with N / NE / NW orientation	0%
	% single aspect with E orientation	75%
	% single aspect with S / SE / SW orientation	0%
	% single aspect with W orientation	25%
Glazing ratio - What is the glazing ratio (glazing; internal floor area) on each facade?	N / NE / NW	5.1%
	E	5.3%
	S / SE / SW	4.6%
	W	5.2%
Daylighting	What is the average daylight factor range?	
Window opening	Are windows openable?	Y
Window opening	What is the average percentage of openable area for the windows?	50%+
Window opening - What is the extent of the opening?	Fully openable	
	Limited (e.g. for security, safety, wind loading reasons)	Limited
Security	Where there are security issues (e.g. ground floor flats) has an alternative night time natural ventilation method been provided (e.g. ventilation grates)?	N/A
Shading	Is there any external shading?	N
	Is there any internal shading?	N
Glazing specification	Is there any solar control glazing?	Yes, G value of 0.5
Ventilation - What is the ventilation strategy?	Natural – background	Make up air to whole dwelling MEV
	Natural – purge	4ACH
	Mechanical – background (e.g. MVHR)	Whole dwelling local MEV
	Mechanical – purge	N
	What is the average design air change rate	Approved Document F Table 5.1a & Table 5.1b
Heating system	Is communal heating present?	Y
	What is the flow/return temperature?	70/40 in flat
	Have horizontal pipe runs been minimised?	Y
	Do the specifications include insulation levels in line with the London Heat Network Manual[31]	N/A

[31] http://www.londonheatmap.org.uk/Content/uploaded/documents/LHNM_Manual2014Low.pdf

Appendix B

Energy Centre



NOTES

1 The Contractor must check and confirm all dimensions
2 All discrepancies must be reported and resolved by the Architect before works commence
3 This drawing is not to be scaled
4 All work and materials to be in accordance with current applicable Statutory Legislation and to comply with all relevant Codes of Practice and British Standards

Rev		Date
P2	Issued for Planning	29/11/18
P1	Issued for Planning	17/07/18

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Client
Hollybrook Limited

Project
Osiers Road

Drawing
Basement Floor Plan

Scale	Date	Status
1:200 (A1)	Mar 18	Planning

Job Number	Drawing Number	Revision
5865	**T20P-1**	**P2**

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Appendix C

PV Layout

NOTES

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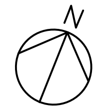

Rev		Date
A	Issued for Information	12/03/19
-	Issued for Information	20/11/18

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Project
Osiers Road

Drawing
Roof Floor Plan

Scale	Date	Status
1:200 (A1)	Nov 18	Planning

Job Number	Drawing Number	Revision
5865	**TSKP14**	**A**

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Appendix D

Calculation Outputs

BE LEAN

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-2-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.94	(1a) x	2.4	(2a) =	179.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.94	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	179.86	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.98	x1/[1/(1.2)+ 0.04]		=	6.85			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Floor			74.94	x	0.11	=	8.243401			(28)
Walls Type1	41.4	14.26	27.14	x	0.18	=	4.89			(29)
Walls Type2	10.58	2.1	8.48	x	0.18	=	1.53			(29)
Total area of elements, m²			126.92							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.5 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 13.31 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 46.81 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.49	76.49	76.49	76.49	76.49	76.49	76.49	76.49	76.49	76.49	76.49	76.49	

Average = Sum(39)$_{1...12}$ /12= 76.49 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	

Average = Sum(40)$_{1...12}$ /12= 1.02 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.36 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	99.27	95.66	92.05	88.44	84.83	81.22	81.22	84.83	88.44	92.05	95.66	99.27	

Total = Sum(44)$_{1...12}$ = 1082.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.22	128.76	132.87	115.83	111.15	95.91	88.88	101.99	103.2	120.27	131.29	142.57	

Total = Sum(45)$_{1...12}$ = 1419.93 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.08	19.31	19.93	17.38	16.67	14.39	13.33	15.3	15.48	18.04	19.69	21.39	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

DER WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.49	178.68	188.14	169.33	166.42	149.4	144.15	157.26	156.7	175.55	184.78	197.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.49	178.68	188.14	169.33	166.42	149.4	144.15	157.26	156.7	175.55	184.78	197.85

Output from water heater (annual)$_{1\ldots12}$ | 2070.77 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.17	82.75	88.4	81.31	81.18	74.69	73.77	78.13	77.11	84.21	86.45	91.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.61	16.53	13.44	10.17	7.61	6.42	6.94	9.02	12.1	15.37	17.94	19.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	208.54	210.71	205.25	193.64	178.99	165.22	156.01	153.85	159.3	170.91	185.57	199.34	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	(71)

Water heating gains (Table 5)

(72)m=	125.23	123.15	118.82	112.93	109.11	103.73	99.16	105.02	107.1	113.19	120.07	123.15	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	410.78	408.77	395.91	375.15	354.1	333.76	320.51	326.28	336.9	357.87	381.97	400.02	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.98	x	10.63	x	0.5	x	0.8	=	17.63	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	5.98	x	20.32	x	0.5	x	0.8	=	33.69	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.98	x	34.53	x	0.5	x	0.8	=	57.24	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.98	x	55.46	x	0.5	x	0.8	=	91.94	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.98	x	74.72	x	0.5	x	0.8	=	123.85	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.98	x	79.99	x	0.5	x	0.8	=	132.59	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.98	x	74.68	x	0.5	x	0.8	=	123.79	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.98	x	59.25	x	0.5	x	0.8	=	98.21	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.98	x	41.52	x	0.5	x	0.8	=	68.82	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.98	x	24.19	x	0.5	x	0.8	=	40.1	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.98	x	13.12	x	0.5	x	0.8	=	21.74	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.98	x	8.86	x	0.5	x	0.8	=	14.69	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)

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East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	48.92	94.17	158.48	247.41	324.7	343.55	322.38	261.3	188.65	111.99	60.55	40.62	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	459.7	502.95	554.39	622.56	678.8	677.31	642.89	587.58	525.55	469.86	442.52	440.63	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.87	0.69	0.52	0.58	0.85	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.95	20.06	20.28	20.58	20.84	20.97	20.99	20.99	20.9	20.57	20.2	19.92	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.99	0.95	0.82	0.6	0.41	0.47	0.78	0.97	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.66	18.83	19.14	19.57	19.91	20.04	20.06	20.06	19.98	19.56	19.03	18.61	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.18	19.32	19.6	19.97	20.28	20.41	20.44	20.43	20.35	19.96	19.5	19.13	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.18	19.32	19.6	19.97	20.28	20.41	20.44	20.43	20.35	19.96	19.5	19.13	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.83	0.63	0.45	0.52	0.8	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	457.88	499.39	544.83	587.91	565.11	428.79	291.34	304.25	422.5	453.12	439.03	439.24	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1137.88	1103.01	1001.83	846.94	656.52	444.68	293.42	308.45	477.78	716.12	948.28	1142.22	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	505.92	405.64	340.01	186.51	68.01	0	0	0	0	195.67	366.66	523.02	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 2591.43 (98)

Space heating requirement in kWh/m²/year 34.58 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2591.43	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2721	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2070.77	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2174.31	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	48.95	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		48.49	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	48.49	(331)
Energy for lighting (calculated in Appendix L)		328.59	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1136.98	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	25.41	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1162.38	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1162.38	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	25.17	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	170.54	(379)
Total CO2, kg/year	sum of (376)…(382) =			1358.09	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.12	(384)
EI rating (section 14)				84.83	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: a1-2-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.94	(1a) x	2.4	(2a) =	179.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.94	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	179.86	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.98	x1/[1/(1.4)+ 0.04]		=	7.93			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Floor			74.94	x	0.13	=	9.7422			(28)
Walls Type1	41.4	14.26	27.14	x	0.18	=	4.89			(29)
Walls Type2	10.58	2.1	8.48	x	0.18	=	1.53			(29)
Total area of elements, m²			126.92							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.16 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.66 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 48.82 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	35.73	35.5	35.27	34.18	33.98	33.04	33.04	32.86	33.4	33.98	34.39	34.82	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	84.55	84.32	84.09	83.01	82.8	81.86	81.86	81.69	82.22	82.8	83.21	83.64	

Average = Sum(39)$_{1...12}$ /12= 83.01 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.13	1.13	1.12	1.11	1.1	1.09	1.09	1.09	1.1	1.1	1.11	1.12	

Average = Sum(40)$_{1...12}$ /12= 1.11 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.36 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	99.27	95.66	92.05	88.44	84.83	81.22	81.22	84.83	88.44	92.05	95.66	99.27	

Total = Sum(44)$_{1...12}$ = 1082.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.22	128.76	132.87	115.83	111.15	95.91	88.88	101.99	103.2	120.27	131.29	142.57	

Total = Sum(45)$_{1...12}$ = 1419.93 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.08	19.31	19.93	17.38	16.67	14.39	13.33	15.3	15.48	18.04	19.69	21.39	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	193.81	170.84	179.46	160.93	157.74	141	135.47	148.58	148.3	166.87	176.38	189.17	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	193.81	170.84	179.46	160.93	157.74	141	135.47	148.58	148.3	166.87	176.38	189.17

Output from water heater (annual)$_{1…12}$ | 1968.55 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.23	76.48	81.45	74.59	74.23	67.96	66.83	71.19	70.39	77.27	79.73	84.68	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.83	16.73	13.6	10.3	7.7	6.5	7.02	9.13	12.25	15.56	18.16	19.36	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	208.54	210.71	205.25	193.64	178.99	165.22	156.01	153.85	159.3	170.91	185.57	199.34	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	(71)

Water heating gains (Table 5)

(72)m=	115.89	113.81	109.48	103.6	99.77	94.39	89.82	95.68	97.76	103.85	110.73	113.82	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	404.67	402.64	389.74	368.94	347.86	327.51	314.26	320.06	330.72	351.72	375.86	393.91	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.98	x	10.63	x	0.63	x	0.7	=	19.43	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)

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North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	5.98	x	20.32	x	0.63	x	0.7	=	37.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	5.98	x	34.53	x	0.63	x	0.7	=	63.11	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	5.98	x	55.46	x	0.63	x	0.7	=	101.36	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	5.98	x	74.72	x	0.63	x	0.7	=	136.55	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	5.98	x	79.99	x	0.63	x	0.7	=	146.18	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	5.98	x	74.68	x	0.63	x	0.7	=	136.48	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	5.98	x	59.25	x	0.63	x	0.7	=	108.28	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	5.98	x	41.52	x	0.63	x	0.7	=	75.87	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	5.98	x	24.19	x	0.63	x	0.7	=	44.21	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	5.98	x	13.12	x	0.63	x	0.7	=	23.97	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	5.98	x	8.86	x	0.63	x	0.7	=	16.2	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)

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East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	53.94	103.83	174.73	272.77	357.98	378.76	355.42	288.08	207.98	123.47	66.76	44.78	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	458.61	506.47	564.46	641.71	705.84	706.27	669.68	608.14	538.7	475.19	442.61	438.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.87	0.69	0.53	0.6	0.86	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.8	19.93	20.17	20.51	20.81	20.96	20.99	20.98	20.87	20.5	20.1	19.78	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.98	19.98	19.99	20	20.01	20.01	20.01	20	20	19.99	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.99	0.95	0.83	0.61	0.41	0.48	0.79	0.97	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.38	18.56	18.92	19.42	19.81	19.98	20	20	19.89	19.41	18.82	18.36	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.95	19.11	19.42	19.85	20.21	20.37	20.4	20.4	20.28	19.84	19.33	18.93	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.95	19.11	19.42	19.85	20.21	20.37	20.4	20.4	20.28	19.84	19.33	18.93	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.95	0.84	0.64	0.46	0.53	0.81	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	456.79	502.87	554.83	606.58	591.16	451.67	307.98	320.49	438.53	459.18	439.22	437.3	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1238.41	1198.11	1086.24	909.27	704.29	472.38	311	326.38	508.5	765.52	1017.86	1231.76	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	581.53	467.2	395.37	217.94	84.17	0	0	0	0	227.92	416.62	591.07	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2981.82 (98)

Space heating requirement in kWh/m²/year 39.79 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system			0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =		1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =		1	(204)
Efficiency of main space heating system 1			93.5	(206)
Efficiency of secondary/supplementary heating system, %			0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	581.53	467.2	395.37	217.94	84.17	0	0	0	0	227.92	416.62	591.07		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	621.95	499.68	422.86	233.09	90.02	0	0	0	0	243.76	445.59	632.16		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3189.11	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)
Water heating														
Output from water heater (calculated above)	193.81	170.84	179.46	160.93	157.74	141	135.47	148.58	148.3	166.87	176.38	189.17		
Efficiency of water heater													79.8	(216)
(217)m=	87.57	87.36	86.86	85.62	83.22	79.8	79.8	79.8	79.8	85.65	87.03	87.65		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	221.33	195.55	206.6	187.95	189.54	176.7	169.76	186.19	185.83	194.84	202.67	215.82		
Total = Sum(219a)$_{1...12}$ =													2332.78	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3189.11	
Water heating fuel used			2332.78	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			332.62	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	688.85	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	503.88	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1192.73	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	172.63	(268)
Total CO2, kg/year		sum of (265)…(271) =		1404.28	(272)

TER = 18.74 (273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-2-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.81	(1a) x	2.4	(2a) =	129.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.81	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	129.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			6.44	x1/[1/(1.2)+ 0.04]		=	7.37			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Floor			53.81	x	0.11	=	5.9191			(28)
Walls Type1	19.19	9.2	9.99	x	0.18	=	1.8			(29)
Walls Type2	16.19	2.1	14.09	x	0.18	=	2.54			(29)
Total area of elements, m²			89.19							(31)
Party wall			35.3	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 23.31 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.98 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 33.29 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	21.31	21.31	21.31	21.31	21.31	21.31	21.31	21.31	21.31	21.31	21.31	21.31	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	

Average = Sum(39)$_{1…12}$ /12= 54.6 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01

Average = Sum(40)$_{1...12}$ /12= 1.01 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.8 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	84.71	81.63	78.55	75.47	72.39	69.31	69.31	72.39	75.47	78.55	81.63	84.71	

Total = Sum(44)$_{1...12}$ = 924.09 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	125.62	109.87	113.37	98.84	94.84	81.84	75.84	87.02	88.06	102.63	112.03	121.66

Total = Sum(45)$_{1...12}$ = 1211.63 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.84	16.48	17.01	14.83	14.23	12.28	11.38	13.05	13.21	15.39	16.8	18.25	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	180.9	159.8	168.65	152.34	150.12	135.33	131.11	142.3	141.56	157.91	165.52	176.93	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	180.9	159.8	168.65	152.34	150.12	135.33	131.11	142.3	141.56	157.91	165.52	176.93	

Output from water heater (annual) 1…12 | 1862.47 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.99	76.47	81.92	75.66	75.76	70.01	69.44	73.16	72.08	78.35	80.04	84.67	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	14.14	12.56	10.22	7.73	5.78	4.88	5.27	6.85	9.2	11.68	13.63	14.54	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	157.11	158.74	154.64	145.89	134.85	124.47	117.54	115.91	120.02	128.76	139.8	150.18	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	(71)
Water heating gains (Table 5)													
(72)m=	115.58	113.8	110.11	105.08	101.82	97.23	93.33	98.33	100.11	105.3	111.17	113.81	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	336.87	335.14	324.99	308.74	292.49	276.62	266.18	271.13	279.36	295.79	314.65	328.56	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	6.44	x	19.64	x	0.5	x	0.8	=	35.06	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	6.44	x	38.42	x	0.5	x	0.8	=	68.59	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	6.44	x	63.27	x	0.5	x	0.8	=	112.95	(76)

East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	6.44	x	92.28	x	0.5	x	0.8	=	164.74	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	6.44	x	113.09	x	0.5	x	0.8	=	201.89	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	6.44	x	115.77	x	0.5	x	0.8	=	206.67	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	6.44	x	110.22	x	0.5	x	0.8	=	196.76	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	6.44	x	94.68	x	0.5	x	0.8	=	169.01	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	6.44	x	73.59	x	0.5	x	0.8	=	131.37	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	6.44	x	45.59	x	0.5	x	0.8	=	81.38	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	6.44	x	24.49	x	0.5	x	0.8	=	43.72	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	6.44	x	16.15	x	0.5	x	0.8	=	28.83	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	50.09	97.98	161.36	235.34	288.41	295.24	281.08	241.45	187.67	116.26	62.45	41.19	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.96	433.12	486.35	544.08	580.9	571.86	547.26	512.58	467.03	412.05	377.1	369.75	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.92	0.79	0.6	0.44	0.49	0.74	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.19	20.43	20.71	20.91	20.98	21	21	20.95	20.68	20.31	20.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.89	0.73	0.52	0.35	0.39	0.67	0.93	0.99	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.82	19.02	19.36	19.74	19.99	20.06	20.07	20.07	20.03	19.72	19.19	18.76	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.61	19.89	20.23	20.45	20.52	20.53	20.53	20.49	20.2	19.75	19.39	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.61	19.89	20.23	20.45	20.52	20.53	20.53	20.49	20.2	19.75	19.39	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.9	0.75	0.55	0.39	0.44	0.7	0.93	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	383.92	426.57	468.27	487.67	438.09	317.33	214.08	224.32	328.47	382.93	371.08	367.45	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	826.65	803.04	731.37	618.48	477.6	323.37	214.8	225.64	348.92	524.13	690.68	829.45	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	329.39	252.99	195.75	94.18	29.39	0	0	0	0	105.05	230.11	343.73	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1580.59 (98)

Space heating requirement in kWh/m²/year 29.37 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1580.59	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1659.62	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1862.47	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1955.59	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	36.15	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		34.82	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			34.82	(331)
Energy for lighting (calculated in Appendix L)				249.76	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	839.66	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	18.76	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	858.43	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				858.43	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	18.07	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	129.62	(379)
Total CO2, kg/year	sum of (376)…(382) =				1006.12	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				18.7	(384)
EI rating (section 14)					86.36	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-2-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.81	(1a) x	2.4	(2a) =	129.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		129.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			6.44	x1/[1/(1.4)+ 0.04]		=	8.54			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Floor			53.81	x	0.13	=	6.9953			(28)
Walls Type1	19.19	9.2	9.99	x	0.18	=	1.8			(29)
Walls Type2	16.19	2.1	14.09	x	0.18	=	2.54			(29)
Total area of elements, m²			89.19							(31)
Party wall			35.3	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.63 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.23 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 33.86 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.41	25.25	25.1	24.36	24.23	23.59	23.59	23.47	23.83	24.23	24.5	24.79	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	59.27	59.11	58.96	58.22	58.08	57.45	57.45	57.33	57.69	58.08	58.36	58.65

Average = $\text{Sum}(39)_{1\ldots12}$ /12= 58.22 (39)

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Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	1.1	1.1	1.1	1.08	1.08	1.07	1.07	1.07	1.07	1.08	1.08	1.09

Average = Sum(40)$_{1…12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 1.8 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 77.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	84.71	81.63	78.55	75.47	72.39	69.31	69.31	72.39	75.47	78.55	81.63	84.71

Total = Sum(44)$_{1…12}$ = 924.09 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	125.62	109.87	113.37	98.84	94.84	81.84	75.84	87.02	88.06	102.63	112.03	121.66

Total = Sum(45)$_{1…12}$ = 1211.63 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.84	16.48	17.01	14.83	14.23	12.28	11.38	13.05	13.21	15.39	16.8	18.25

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.39 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = — 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = — 0 (54)

Enter (50) or (54) in (55) — 0.75 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	172.21	151.95	159.97	143.93	141.44	126.93	122.43	133.62	133.16	149.22	157.12	168.25	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	172.21	151.95	159.97	143.93	141.44	126.93	122.43	133.62	133.16	149.22	157.12	168.25

Output from water heater (annual)$_{1...12}$ 1760.24 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	79.04	70.2	74.97	68.94	68.81	63.29	62.49	66.21	65.35	71.4	73.32	77.73	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.43	12.82	10.42	7.89	5.9	4.98	5.38	6.99	9.39	11.92	13.91	14.83	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	157.11	158.74	154.64	145.89	134.85	124.47	117.54	115.91	120.02	128.76	139.8	150.18	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	(71)

Water heating gains (Table 5)

(72)m=	106.24	104.46	100.77	95.75	92.49	87.9	83.99	88.99	90.77	95.97	101.84	104.47	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	330.82	329.06	318.87	302.57	286.27	270.39	259.95	264.93	273.21	289.69	308.59	322.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	6.44	x	19.64	x	0.63	x	0.7	=	38.65	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	6.44	x	38.42	x	0.63	x	0.7	=	75.62	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	6.44	x	63.27	x	0.63	x	0.7	=	124.53	(76)

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East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	6.44	x	92.28	x	0.63	x	0.7	=	181.62	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	6.44	x	113.09	x	0.63	x	0.7	=	222.58	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	6.44	x	115.77	x	0.63	x	0.7	=	227.85	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	6.44	x	110.22	x	0.63	x	0.7	=	216.93	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	6.44	x	94.68	x	0.63	x	0.7	=	186.34	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	6.44	x	73.59	x	0.63	x	0.7	=	144.83	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	6.44	x	45.59	x	0.63	x	0.7	=	89.73	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	6.44	x	24.49	x	0.63	x	0.7	=	48.2	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	6.44	x	16.15	x	0.63	x	0.7	=	31.79	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	55.22	108.02	177.9	259.46	317.98	325.5	309.89	266.19	206.91	128.18	68.85	45.41	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.05	437.09	496.77	562.02	604.25	595.89	569.85	531.13	480.12	417.87	377.45	367.93	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.92	0.79	0.6	0.44	0.49	0.75	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.09	20.35	20.67	20.89	20.98	21	20.99	20.94	20.63	20.23	19.91	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20	20	20.02	20.02	20.03	20.03	20.03	20.02	20.02	20.01	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.89	0.73	0.52	0.34	0.39	0.67	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.59	18.81	19.19	19.64	19.92	20.02	20.03	20.03	19.98	19.61	19.03	18.56	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.26	19.45	19.77	20.15	20.4	20.5	20.51	20.51	20.46	20.12	19.63	19.23	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.26	19.45	19.77	20.15	20.4	20.5	20.51	20.51	20.46	20.12	19.63	19.23	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.96	0.9	0.76	0.56	0.39	0.44	0.71	0.93	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	383.15	430.69	478.8	504.52	457.83	331.41	223.75	233.95	341.43	389.87	371.75	365.74	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	886.79	860.03	782.19	655.25	505.5	338.8	224.71	235.66	366.7	553.05	731.13	881.77	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	374.71	288.52	225.72	108.53	35.47	0	0	0	0	121.41	258.75	383.92	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1797.03 (98)

Space heating requirement in kWh/m²/year 33.4 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	374.71	288.52	225.72	108.53	35.47	0	0	0	0	121.41	258.75	383.92	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	400.76	308.58	241.42	116.07	37.93	0	0	0	0	129.85	276.74	410.61	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1921.96 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)														
	172.21	151.95	159.97	143.93	141.44	126.93	122.43	133.62	133.16	149.22	157.12	168.25		
Efficiency of water heater													79.8	(216)
(217)m=	86.83	86.5	85.73	84.07	81.74	79.8	79.8	79.8	79.8	84.27	86.14	86.95		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	198.33	175.67	186.59	171.2	173.04	159.06	153.42	167.44	166.86	177.08	182.41	193.51		

Total = Sum(219a)$_{1...12}$ = 2104.62 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1921.96

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Water heating fuel used			2104.62	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			254.86	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	415.14	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	454.6	(264)
Space and water heating	(261) + (262) + (263) + (264) =			869.74	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	132.27	(268)
Total CO2, kg/year		sum of (265)…(271) =		1040.94	(272)

TER =	19.34	(273)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: a1-2-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.35	(1a) x	2.4	(2a) =	176.04	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.35	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.04	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.06	x1/[1/(1.2)+ 0.04]		=	5.79			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Floor			73.35	x	0.11	=	8.0685			(28)
Walls Type1	41.75	10.58	31.17	x	0.18	=	5.61			(29)
Walls Type2	13.03	2.1	10.93	x	0.18	=	1.97			(29)
Total area of elements, m²			128.13							(31)
Party wall			28.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.04 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 42.32 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.05	29.05	29.05	29.05	29.05	29.05	29.05	29.05	29.05	29.05	29.05	29.05	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	71.37	71.37	71.37	71.37	71.37	71.37	71.37	71.37	71.37	71.37	71.37	71.37	

Average = Sum(39)$_{1\ldots12}$ /12= 71.37 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97

Average = Sum(40)$_{1...12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.32 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.41 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.35	94.77	91.2	87.62	84.05	80.47	80.47	84.05	87.62	91.2	94.77	98.35	
										Total = Sum(44)$_{1...12}$ =		1072.92	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	145.85	127.56	131.63	114.76	110.12	95.02	88.05	101.04	102.25	119.16	130.07	141.25	
										Total = Sum(45)$_{1...12}$ =		1406.77	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	21.88	19.13	19.75	17.21	16.52	14.25	13.21	15.16	15.34	17.87	19.51	21.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.13	177.49	186.91	168.25	165.39	148.52	143.33	156.32	155.74	174.44	183.57	196.53	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.13	177.49	186.91	168.25	165.39	148.52	143.33	156.32	155.74	174.44	183.57	196.53	

Output from water heater (annual)$_{1...12}$ 2057.61 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.72	82.36	87.99	80.95	80.84	74.39	73.5	77.82	76.79	83.84	86.04	91.19	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.96	16.84	13.69	10.37	7.75	6.54	7.07	9.19	12.33	15.66	18.28	19.48	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	204.99	207.11	201.75	190.34	175.94	162.4	153.35	151.23	156.59	168	182.4	195.94	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	(71)

Water heating gains (Table 5)

(72)m=	124.62	122.55	118.27	112.43	108.65	103.32	98.79	104.59	106.66	112.69	119.51	122.56	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	406.43	404.37	391.58	371.01	350.2	330.13	317.08	322.88	333.44	354.22	378.05	395.86	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.06	x	19.64	x	0.5	x	0.8	=	27.55	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	5.06	x	38.42	x	0.5	x	0.8	=	53.89	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	5.06	x	63.27	x	0.5	x	0.8	=	88.75	(76)

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East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	5.06	x	92.28	x	0.5	x	0.8	=	129.44	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	5.06	x	113.09	x	0.5	x	0.8	=	158.63	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	5.06	x	115.77	x	0.5	x	0.8	=	162.38	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	5.06	x	110.22	x	0.5	x	0.8	=	154.6	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	5.06	x	94.68	x	0.5	x	0.8	=	132.8	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	5.06	x	73.59	x	0.5	x	0.8	=	103.22	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	5.06	x	45.59	x	0.5	x	0.8	=	63.94	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	5.06	x	24.49	x	0.5	x	0.8	=	34.35	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	5.06	x	16.15	x	0.5	x	0.8	=	22.65	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	78.34	141.86	211.78	284.37	333.04	335.53	321.56	285.48	237.47	162.01	95.48	65.92	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	484.77	546.24	603.36	655.39	683.24	665.66	638.64	608.36	570.91	516.22	473.54	461.78	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.84	0.66	0.49	0.53	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.2	20.41	20.67	20.88	20.98	21	20.99	20.94	20.67	20.31	20.02	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.92	0.79	0.58	0.39	0.43	0.71	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.86	19.05	19.36	19.73	19.99	20.09	20.1	20.1	20.06	19.73	19.22	18.8	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.34	19.51	19.78	20.11	20.35	20.44	20.46	20.46	20.41	20.11	19.65	19.29	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.34	19.51	19.78	20.11	20.35	20.44	20.46	20.46	20.41	20.11	19.65	19.29	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.92	0.81	0.61	0.43	0.47	0.74	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	482.03	539.87	586.29	604.55	550.29	406.11	274.33	287.6	420.03	485.87	467.78	459.76	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1073.23	1042.66	948.03	799.76	617.12	417.13	275.57	289.74	450.44	678.62	895.88	1076.8	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	439.86	337.87	269.13	140.55	49.72	0	0	0	0	143.4	308.23	459.08	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2147.84 (98)

Space heating requirement in kWh/m²/year 29.28 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2147.84	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2255.23	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308

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Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2057.61	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2160.49	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	44.16	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		47.46	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	47.46	(331)
Energy for lighting (calculated in Appendix L)		334.76	(332)

12b. CO_2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1025.59	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	22.92	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1048.5	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1048.5	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	24.63	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	173.74	(379)
Total CO2, kg/year	sum of (376)…(382) =				1246.88	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17	(384)
EI rating (section 14)					85.88	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-2-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.35	(1a) x	2.4	(2a) =	176.04	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.35	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.04	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.06	x1/[1/(1.4)+ 0.04]		=	6.71			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Floor			73.35	x	0.13	=	9.5355			(28)
Walls Type1	41.75	10.58	31.17	x	0.18	=	5.61			(29)
Walls Type2	13.03	2.1	10.93	x	0.18	=	1.97			(29)
Total area of elements, m²			128.13							(31)
Party wall			28.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	33.24	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		11.01	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	44.25	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.08	34.84	34.61	33.53	33.33	32.39	32.39	32.22	32.76	33.33	33.74	34.17	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	79.33	79.09	78.86	77.79	77.58	76.65	76.65	76.47	77.01	77.58	77.99	78.42	

Average = Sum(39)$_{1…12}$ /12= 77.78 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.08	1.08	1.08	1.06	1.06	1.04	1.04	1.04	1.05	1.06	1.06	1.07

Average = Sum(40)$_{1…12}$ /12= 1.06 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.32 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.41 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.35	94.77	91.2	87.62	84.05	80.47	80.47	84.05	87.62	91.2	94.77	98.35	
										Total = Sum(44)$_{1…12}$ =		1072.92	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	145.85	127.56	131.63	114.76	110.12	95.02	88.05	101.04	102.25	119.16	130.07	141.25	
										Total = Sum(45)$_{1…12}$ =		1406.77	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	21.88	19.13	19.75	17.21	16.52	14.25	13.21	15.16	15.34	17.87	19.51	21.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	192.45	169.65	178.23	159.85	156.71	140.11	134.65	147.64	147.34	165.75	175.16	187.84	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	192.45	169.65	178.23	159.85	156.71	140.11	134.65	147.64	147.34	165.75	175.16	187.84	

Output from water heater (annual)$_{1...12}$ 1955.39 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.77	76.08	81.04	74.23	73.89	67.67	66.55	70.87	70.07	76.9	79.32	84.24	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	19.48	17.3	14.07	10.65	7.96	6.72	7.26	9.44	12.67	16.09	18.78	20.02	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	204.99	207.11	201.75	190.34	175.94	162.4	153.35	151.23	156.59	168	182.4	195.94	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	(71)
Water heating gains (Table 5)													
(72)m=	115.28	113.22	108.93	103.1	99.31	93.98	89.45	95.26	97.32	103.36	110.17	113.23	(72)
Total internal gains =						(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m							
(73)m=	400.62	398.5	385.62	364.96	344.08	323.97	310.94	316.8	327.45	348.31	372.22	390.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.06	x	19.64	x	0.63	x	0.7	=	30.37	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	5.06	x	38.42	x	0.63	x	0.7	=	59.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	5.06	x	63.27	x	0.63	x	0.7	=	97.85	(76)

East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	5.06	x	92.28	x	0.63	x	0.7	=	142.7	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	5.06	x	113.09	x	0.63	x	0.7	=	174.89	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	5.06	x	115.77	x	0.63	x	0.7	=	179.03	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	5.06	x	110.22	x	0.63	x	0.7	=	170.44	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	5.06	x	94.68	x	0.63	x	0.7	=	146.41	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	5.06	x	73.59	x	0.63	x	0.7	=	113.8	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	5.06	x	45.59	x	0.63	x	0.7	=	70.5	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	5.06	x	24.49	x	0.63	x	0.7	=	37.87	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	5.06	x	16.15	x	0.63	x	0.7	=	24.98	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.37	156.41	233.49	313.52	367.17	369.93	354.52	314.74	261.81	178.61	105.27	72.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	486.99	554.91	619.11	678.48	711.26	693.9	665.46	631.54	589.26	526.93	477.49	462.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.85	0.67	0.5	0.55	0.8	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.91	20.06	20.3	20.61	20.85	20.97	20.99	20.99	20.92	20.61	20.21	19.89	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.02	20.02	20.02	20.03	20.04	20.05	20.05	20.05	20.04	20.04	20.03	20.03	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.8	0.59	0.4	0.44	0.72	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.57	18.79	19.14	19.58	19.89	20.03	20.04	20.04	19.98	19.59	19.01	18.54	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.11	19.3	19.61	19.99	20.27	20.4	20.42	20.42	20.36	20	19.49	19.08	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.11	19.3	19.61	19.99	20.27	20.4	20.42	20.42	20.36	20	19.49	19.08	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.92	0.81	0.62	0.44	0.48	0.75	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	484.25	548.51	602.08	627.52	578.62	429.6	291.19	304.48	440.98	497.76	471.88	460.71	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1174.55	1138.93	1033.7	862.78	665.02	444.72	293.11	307.66	481.75	729.1	966.23	1166.89	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	513.58	396.76	321.12	169.38	64.28	0	0	0	0	172.12	355.93	525.4	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2518.56 (98)

Space heating requirement in kWh/m²/year 34.34 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	513.58	396.76	321.12	169.38	64.28	0	0	0	0	172.12	355.93	525.4	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	549.28	424.34	343.45	181.16	68.75	0	0	0	0	184.08	380.67	561.92	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2693.65 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

192.45	169.65	178.23	159.85	156.71	140.11	134.65	147.64	147.34	165.75	175.16	187.84

Efficiency of water heater 79.8 (216)

(217)m=	87.31	87.01	86.37	84.97	82.64	79.8	79.8	79.8	79.8	84.91	86.67	87.41	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	220.42	194.99	206.36	188.13	189.63	175.58	168.73	185.01	184.64	195.2	202.11	214.89

Total = Sum(219a)$_{1...12}$ = 2325.69 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2693.65	
Water heating fuel used		2325.69	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		344.01	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	581.83	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	502.35	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1084.18	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	178.54	(268)
Total CO2, kg/year			sum of (265)…(271) =		1301.64	(272)

TER = 17.75 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-2-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	72.42	(1a) x	2.4	(2a) =	173.81	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.42	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	173.81	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			5.98	x1/[1/(1.2)+ 0.04]		=	6.85			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Floor			72.42	x	0.11	=	7.9662			(28)
Walls Type1	46.63	16.1	30.53	x	0.18	=	5.5			(29)
Walls Type2	26.01	2.1	23.91	x	0.18	=	4.3			(29)
Total area of elements, m²			145.06							(31)
Party wall			20.62	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.72 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.27 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 52.99 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	81.67	81.67	81.67	81.67	81.67	81.67	81.67	81.67	81.67	81.67	81.67	81.67	

Average = Sum(39)$_{1…12}$ /12= 81.67 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	

Average = Sum(40)$_{1…12}$ /12= 1.13 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.3 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.91 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.8	94.24	90.68	87.13	83.57	80.02	80.02	83.57	87.13	90.68	94.24	97.8

Total = Sum(44)$_{1…12}$ = 1066.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.03	126.84	130.89	114.11	109.5	94.49	87.56	100.47	101.67	118.49	129.34	140.45

Total = Sum(45)$_{1…12}$ = 1398.84 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.75	19.03	19.63	17.12	16.42	14.17	13.13	15.07	15.25	17.77	19.4	21.07	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	200.31	176.77	186.17	167.61	164.77	147.98	142.83	155.75	155.16	173.76	182.83	195.73	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	200.31	176.77	186.17	167.61	164.77	147.98	142.83	155.75	155.16	173.76	182.83	195.73

Output from water heater (annual)$_{1...12}$ | 2049.68 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.44	82.12	87.74	80.74	80.63	74.21	73.33	77.63	76.6	83.62	85.8	90.92	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.09	16.06	13.06	9.89	7.39	6.24	6.74	8.77	11.77	14.94	17.44	18.59	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	202.88	204.98	199.68	188.38	174.13	160.73	151.78	149.67	154.98	166.27	180.53	193.93	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	(71)

Water heating gains (Table 5)

(72)m=	124.25	122.2	117.93	112.14	108.37	103.07	98.57	104.34	106.39	112.39	119.17	122.21	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	402.77	400.8	388.23	367.96	347.44	327.59	314.64	320.33	330.68	351.15	374.68	392.27	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	5.98	x	46.75	x	0.5	x	0.8	=	77.5	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	5.98	x	76.57	x	0.5	x	0.8	=	126.92	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	5.98	x	97.53	x	0.5	x	0.8	=	161.68	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	5.98	x	110.23	x	0.5	x	0.8	=	182.73	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	5.98	x	114.87	x	0.5	x	0.8	=	190.42	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	5.98	x	110.55	x	0.5	x	0.8	=	183.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	5.98	x	108.01	x	0.5	x	0.8	=	179.05	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	5.98	x	104.89	x	0.5	x	0.8	=	173.88	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	5.98	x	101.89	x	0.5	x	0.8	=	168.89	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	5.98	x	82.59	x	0.5	x	0.8	=	136.9	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	5.98	x	55.42	x	0.5	x	0.8	=	91.86	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	5.98	x	40.4	x	0.5	x	0.8	=	66.97	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)

West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	153.34	263.89	365.39	455.34	509.03	504.02	486.55	447.29	396.98	293.09	184.22	130.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	556.11	664.69	753.62	823.3	856.48	831.61	801.19	767.62	727.66	644.25	558.91	523.1	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.78	0.61	0.44	0.48	0.71	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.94	20.14	20.4	20.68	20.88	20.97	21	20.99	20.94	20.67	20.24	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.87	0.72	0.52	0.34	0.38	0.63	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.59	18.87	19.24	19.62	19.87	19.96	19.98	19.98	19.94	19.62	19.02	18.51	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.13	19.38	19.71	20.05	20.28	20.37	20.38	20.38	20.34	20.04	19.51	19.06	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.13	19.38	19.71	20.05	20.28	20.37	20.38	20.38	20.34	20.04	19.51	19.06	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.88	0.74	0.55	0.38	0.42	0.66	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	550.4	648.84	712.61	720.52	635.79	459.45	307.58	322.91	481.64	580.71	546.56	519.03	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1211.15	1182.45	1078.54	910.27	700.41	471.02	309.05	325.26	509.59	771.13	1013.21	1213.89	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	491.6	358.58	272.25	136.62	48.08	0	0	0	0	141.67	335.99	516.98	

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2301.77	(98)
Space heating requirement in kWh/m²/year		31.78	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2301.77	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2416.86	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2049.68	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2152.16	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	45.69	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.86	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			46.86	(331)
Energy for lighting (calculated in Appendix L)				319.42	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1061.19	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	23.71	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1084.9	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1084.9	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	24.32	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	165.78	(379)
Total CO2, kg/year	sum of (376)…(382) =				1275	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17.61	(384)
EI rating (section 14)					85.45	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-2-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	72.42	(1a) x	2.4	(2a) =	173.81	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.42	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	173.81	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.74	x1/[1/(1.4)+ 0.04]		=	3.63			(27)
Windows Type 2			5.94	x1/[1/(1.4)+ 0.04]		=	7.87			(27)
Windows Type 3			2.74	x1/[1/(1.4)+ 0.04]		=	3.63			(27)
Windows Type 4			1.83	x1/[1/(1.4)+ 0.04]		=	2.43			(27)
Windows Type 5			2.74	x1/[1/(1.4)+ 0.04]		=	3.63			(27)
Floor			72.42	x	0.13	=	9.414599			(28)
Walls Type1	46.63	15.99	30.64	x	0.18	=	5.52			(29)
Walls Type2	26.01	2.1	23.91	x	0.18	=	4.3			(29)
Total area of elements, m²			145.06							(31)
Party wall			20.62	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.53 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 13.88 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 56.41 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.69	34.46	34.23	33.16	32.95	32.02	32.02	31.84	32.38	32.95	33.36	33.79	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	91.1	90.87	90.64	89.57	89.36	88.43	88.43	88.25	88.79	89.36	89.77	90.2	

Average = Sum(39)$_{1…12}$ /12= 89.57 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.26	1.25	1.25	1.24	1.23	1.22	1.22	1.22	1.23	1.23	1.24	1.25	

Average = Sum(40)$_{1…12}$ /12= 1.24 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.3 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.91 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	97.8	94.24	90.68	87.13	83.57	80.02	80.02	83.57	87.13	90.68	94.24	97.8	

Total = Sum(44)$_{1…12}$ = 1066.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.03	126.84	130.89	114.11	109.5	94.49	87.56	100.47	101.67	118.49	129.34	140.45	

Total = Sum(45)$_{1…12}$ = 1398.84 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.75	19.03	19.63	17.12	16.42	14.17	13.13	15.07	15.25	17.77	19.4	21.07	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.62	168.93	177.49	159.21	156.09	139.58	134.15	147.07	146.76	165.08	174.43	187.05	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.62	168.93	177.49	159.21	156.09	139.58	134.15	147.07	146.76	165.08	174.43	187.05

Output from water heater (annual)$_{1\ldots12}$ | 1947.46 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.5	75.84	80.8	74.02	73.68	67.49	66.39	70.68	69.88	76.67	79.08	83.98	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.09	16.07	13.07	9.89	7.4	6.24	6.75	8.77	11.77	14.94	17.44	18.59	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	202.88	204.98	199.68	188.38	174.13	160.73	151.78	149.67	154.98	166.27	180.53	193.93	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	(71)

Water heating gains (Table 5)

(72)m=	114.92	112.86	108.6	102.8	99.04	93.74	89.23	95	97.05	103.06	109.83	112.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	396.44	394.47	381.9	361.63	341.11	321.26	308.31	313.99	324.35	344.82	368.35	385.94	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	5.94	x	46.75	x	0.63	x	0.7	=	84.87	(78)
South	0.9x	0.77	x	2.74	x	46.75	x	0.63	x	0.7	=	39.15	(78)
South	0.9x	0.77	x	5.94	x	76.57	x	0.63	x	0.7	=	139	(78)
South	0.9x	0.77	x	2.74	x	76.57	x	0.63	x	0.7	=	64.12	(78)
South	0.9x	0.77	x	5.94	x	97.53	x	0.63	x	0.7	=	177.06	(78)
South	0.9x	0.77	x	2.74	x	97.53	x	0.63	x	0.7	=	81.67	(78)
South	0.9x	0.77	x	5.94	x	110.23	x	0.63	x	0.7	=	200.11	(78)
South	0.9x	0.77	x	2.74	x	110.23	x	0.63	x	0.7	=	92.31	(78)
South	0.9x	0.77	x	5.94	x	114.87	x	0.63	x	0.7	=	208.53	(78)
South	0.9x	0.77	x	2.74	x	114.87	x	0.63	x	0.7	=	96.19	(78)
South	0.9x	0.77	x	5.94	x	110.55	x	0.63	x	0.7	=	200.68	(78)
South	0.9x	0.77	x	2.74	x	110.55	x	0.63	x	0.7	=	92.57	(78)
South	0.9x	0.77	x	5.94	x	108.01	x	0.63	x	0.7	=	196.08	(78)
South	0.9x	0.77	x	2.74	x	108.01	x	0.63	x	0.7	=	90.45	(78)
South	0.9x	0.77	x	5.94	x	104.89	x	0.63	x	0.7	=	190.42	(78)
South	0.9x	0.77	x	2.74	x	104.89	x	0.63	x	0.7	=	87.84	(78)
South	0.9x	0.77	x	5.94	x	101.89	x	0.63	x	0.7	=	184.96	(78)
South	0.9x	0.77	x	2.74	x	101.89	x	0.63	x	0.7	=	85.32	(78)
South	0.9x	0.77	x	5.94	x	82.59	x	0.63	x	0.7	=	149.92	(78)
South	0.9x	0.77	x	2.74	x	82.59	x	0.63	x	0.7	=	69.16	(78)
South	0.9x	0.77	x	5.94	x	55.42	x	0.63	x	0.7	=	100.6	(78)
South	0.9x	0.77	x	2.74	x	55.42	x	0.63	x	0.7	=	46.41	(78)
South	0.9x	0.77	x	5.94	x	40.4	x	0.63	x	0.7	=	73.34	(78)
South	0.9x	0.77	x	2.74	x	40.4	x	0.63	x	0.7	=	33.83	(78)
West	0.9x	0.77	x	2.74	x	19.64	x	0.63	x	0.7	=	16.45	(80)
West	0.9x	0.77	x	1.83	x	19.64	x	0.63	x	0.7	=	10.98	(80)
West	0.9x	0.77	x	2.74	x	19.64	x	0.63	x	0.7	=	16.45	(80)
West	0.9x	0.77	x	2.74	x	38.42	x	0.63	x	0.7	=	32.17	(80)
West	0.9x	0.77	x	1.83	x	38.42	x	0.63	x	0.7	=	21.49	(80)
West	0.9x	0.77	x	2.74	x	38.42	x	0.63	x	0.7	=	32.17	(80)
West	0.9x	0.77	x	2.74	x	63.27	x	0.63	x	0.7	=	52.98	(80)
West	0.9x	0.77	x	1.83	x	63.27	x	0.63	x	0.7	=	35.39	(80)
West	0.9x	0.77	x	2.74	x	63.27	x	0.63	x	0.7	=	52.98	(80)
West	0.9x	0.77	x	2.74	x	92.28	x	0.63	x	0.7	=	77.27	(80)
West	0.9x	0.77	x	1.83	x	92.28	x	0.63	x	0.7	=	51.61	(80)
West	0.9x	0.77	x	2.74	x	92.28	x	0.63	x	0.7	=	77.27	(80)
West	0.9x	0.77	x	2.74	x	113.09	x	0.63	x	0.7	=	94.7	(80)
West	0.9x	0.77	x	1.83	x	113.09	x	0.63	x	0.7	=	63.25	(80)
West	0.9x	0.77	x	2.74	x	113.09	x	0.63	x	0.7	=	94.7	(80)
West	0.9x	0.77	x	2.74	x	115.77	x	0.63	x	0.7	=	96.94	(80)
West	0.9x	0.77	x	1.83	x	115.77	x	0.63	x	0.7	=	64.75	(80)

West	0.9x	0.77	x	2.74	x	115.77	x	0.63	x	0.7	=	96.94	(80)
West	0.9x	0.77	x	2.74	x	110.22	x	0.63	x	0.7	=	92.29	(80)
West	0.9x	0.77	x	1.83	x	110.22	x	0.63	x	0.7	=	61.64	(80)
West	0.9x	0.77	x	2.74	x	110.22	x	0.63	x	0.7	=	92.29	(80)
West	0.9x	0.77	x	2.74	x	94.68	x	0.63	x	0.7	=	79.28	(80)
West	0.9x	0.77	x	1.83	x	94.68	x	0.63	x	0.7	=	52.95	(80)
West	0.9x	0.77	x	2.74	x	94.68	x	0.63	x	0.7	=	79.28	(80)
West	0.9x	0.77	x	2.74	x	73.59	x	0.63	x	0.7	=	61.62	(80)
West	0.9x	0.77	x	1.83	x	73.59	x	0.63	x	0.7	=	41.16	(80)
West	0.9x	0.77	x	2.74	x	73.59	x	0.63	x	0.7	=	61.62	(80)
West	0.9x	0.77	x	2.74	x	45.59	x	0.63	x	0.7	=	38.18	(80)
West	0.9x	0.77	x	1.83	x	45.59	x	0.63	x	0.7	=	25.5	(80)
West	0.9x	0.77	x	2.74	x	45.59	x	0.63	x	0.7	=	38.18	(80)
West	0.9x	0.77	x	2.74	x	24.49	x	0.63	x	0.7	=	20.51	(80)
West	0.9x	0.77	x	1.83	x	24.49	x	0.63	x	0.7	=	13.7	(80)
West	0.9x	0.77	x	2.74	x	24.49	x	0.63	x	0.7	=	20.51	(80)
West	0.9x	0.77	x	2.74	x	16.15	x	0.63	x	0.7	=	13.52	(80)
West	0.9x	0.77	x	1.83	x	16.15	x	0.63	x	0.7	=	9.03	(80)
West	0.9x	0.77	x	2.74	x	16.15	x	0.63	x	0.7	=	13.52	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	167.9	288.95	400.08	498.58	557.37	551.89	532.76	489.76	434.67	320.92	201.72	143.25	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	564.33	683.41	781.98	860.21	898.48	873.15	841.06	803.76	759.03	665.75	570.07	529.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.91	0.79	0.62	0.46	0.5	0.73	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.78	19.99	20.29	20.61	20.85	20.97	20.99	20.99	20.92	20.61	20.13	19.74	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.87	19.88	19.88	19.89	19.89	19.9	19.9	19.91	19.9	19.89	19.89	19.88	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.88	0.73	0.52	0.35	0.38	0.64	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.27	18.59	19	19.46	19.75	19.88	19.9	19.9	19.84	19.46	18.79	18.22	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.88	19.15	19.52	19.92	20.19	20.32	20.34	20.34	20.28	19.92	19.32	18.83	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.88	19.15	19.52	19.92	20.19	20.32	20.34	20.34	20.28	19.92	19.32	18.83	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.88	0.75	0.56	0.39	0.43	0.67	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	558.37	666.86	739.76	754.81	673.82	489.21	328.24	343.9	510.35	602.13	557.44	524.91	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1327.89	1294.98	1179.83	987.07	758.87	505.39	330.54	347.45	548.39	832.97	1097.3	1319.67	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	572.52	422.09	327.42	167.23	63.28	0	0	0	0	171.74	388.7	591.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2704.28 (98)

Space heating requirement in kWh/m²/year 37.34 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	572.52	422.09	327.42	167.23	63.28	0	0	0	0	171.74	388.7	591.3		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	612.32	451.43	350.18	178.86	67.68	0	0	0	0	183.68	415.72	632.4		
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													2892.28	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)														
	191.62	168.93	177.49	159.21	156.09	139.58	134.15	147.07	146.76	165.08	174.43	187.05		
Efficiency of water heater													79.8	(216)
(217)m=	87.56	87.16	86.43	84.95	82.62	79.8	79.8	79.8	79.8	84.92	86.89	87.67		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	218.86	193.82	205.36	187.42	188.93	174.91	168.11	184.29	183.91	194.4	200.75	213.34		
Total = Sum(219a)$_{1...12}$ =													2314.1	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2892.28

Water heating fuel used		2314.1	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		319.49	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	624.73	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	499.85	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1124.58	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	165.82	(268)
Total CO2, kg/year		sum of (265)…(271) =		1329.32	(272)

TER = 18.36 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-2-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	120.39	(1a) x	2.4	(2a) =	288.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	120.39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	288.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			3.68	x1/[1/(1.2)+ 0.04]		=	4.21			(27)
Windows Type 2			5.06	x1/[1/(1.2)+ 0.04]		=	5.79			(27)
Windows Type 3			3.22	x1/[1/(1.2)+ 0.04]		=	3.69			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Floor			120.39	x	0.11	=	13.2429			(28)
Walls Type1	32.79	17.48	15.31	x	0.18	=	2.76			(29)
Walls Type2	25.04	2.1	22.94	x	0.18	=	4.13			(29)
Total area of elements, m²			178.22							(31)
Party wall			61.8	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	42.66	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		15.22	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	57.88	(37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	

Average = Sum(39)$_{1...12}$ /12= 105.55 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	

Average = Sum(40)$_{1...12}$ /12= 0.88 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.86 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 102.24 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	112.46	108.37	104.28	100.19	96.1	92.02	92.02	96.1	100.19	104.28	108.37	112.46	

Total = Sum(44)$_{1...12}$ = 1226.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.78	145.87	150.52	131.23	125.92	108.66	100.69	115.54	116.92	136.26	148.74	161.52	

Total = Sum(45)$_{1...12}$ = 1608.62 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.02	21.88	22.58	19.68	18.89	16.3	15.1	17.33	17.54	20.44	22.31	24.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	222.06	195.79	205.8	184.72	181.19	162.15	155.96	170.82	170.41	191.53	202.23	216.79	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	222.06	195.79	205.8	184.72	181.19	162.15	155.96	170.82	170.41	191.53	202.23	216.79

Output from water heater (annual)$_{1…12}$ | 2259.46 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	99.68	88.44	94.27	86.43	86.09	78.92	77.7	82.64	81.67	89.53	92.25	97.93	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	26.39	23.44	19.06	14.43	10.79	9.11	9.84	12.79	17.17	21.8	25.44	27.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	285.72	288.68	281.21	265.31	245.23	226.36	213.75	210.79	218.26	234.16	254.24	273.11	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	(71)

Water heating gains (Table 5)

(72)m=	133.97	131.61	126.71	120.04	115.71	109.62	104.43	111.07	113.43	120.33	128.12	131.62	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	512.05	509.71	492.95	465.75	437.7	411.05	394	400.62	414.83	442.27	473.78	497.83	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	3.68	x	10.63	x	0.5	x	0.8	=	10.85	(74)
North	0.9x	0.77	x	5.06	x	10.63	x	0.5	x	0.8	=	14.91	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	3.68	x	20.32	x	0.5	x	0.8	=	20.73	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.5	x	0.8	=	28.5	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	3.68	x	34.53	x	0.5	x	0.8	=	35.22	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.5	x	0.8	=	48.43	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	3.68	x	55.46	x	0.5	x	0.8	=	56.58	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.5	x	0.8	=	77.8	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	3.68	x	74.72	x	0.5	x	0.8	=	76.22	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.5	x	0.8	=	104.8	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	3.68	x	79.99	x	0.5	x	0.8	=	81.59	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.5	x	0.8	=	112.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	3.68	x	74.68	x	0.5	x	0.8	=	76.18	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.5	x	0.8	=	104.74	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	3.68	x	59.25	x	0.5	x	0.8	=	60.44	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.5	x	0.8	=	83.1	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	3.68	x	41.52	x	0.5	x	0.8	=	42.35	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.5	x	0.8	=	58.23	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	3.68	x	24.19	x	0.5	x	0.8	=	24.68	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.5	x	0.8	=	33.93	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	3.68	x	13.12	x	0.5	x	0.8	=	13.38	(74)

North	0.9x	0.77	x	5.06	x	13.12	x	0.5	x	0.8	=	18.4	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	3.68	x	8.86	x	0.5	x	0.8	=	9.04	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.5	x	0.8	=	12.43	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
South	0.9x	0.77	x	3.22	x	46.75	x	0.5	x	0.8	=	41.73	(78)
South	0.9x	0.77	x	3.22	x	76.57	x	0.5	x	0.8	=	68.34	(78)
South	0.9x	0.77	x	3.22	x	97.53	x	0.5	x	0.8	=	87.06	(78)
South	0.9x	0.77	x	3.22	x	110.23	x	0.5	x	0.8	=	98.39	(78)
South	0.9x	0.77	x	3.22	x	114.87	x	0.5	x	0.8	=	102.53	(78)
South	0.9x	0.77	x	3.22	x	110.55	x	0.5	x	0.8	=	98.67	(78)
South	0.9x	0.77	x	3.22	x	108.01	x	0.5	x	0.8	=	96.41	(78)
South	0.9x	0.77	x	3.22	x	104.89	x	0.5	x	0.8	=	93.63	(78)
South	0.9x	0.77	x	3.22	x	101.89	x	0.5	x	0.8	=	90.94	(78)
South	0.9x	0.77	x	3.22	x	82.59	x	0.5	x	0.8	=	73.71	(78)
South	0.9x	0.77	x	3.22	x	55.42	x	0.5	x	0.8	=	49.46	(78)
South	0.9x	0.77	x	3.22	x	40.4	x	0.5	x	0.8	=	36.06	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	83.76	148.67	223.55	317.64	397.87	414.85	391.6	327.82	255.05	169.33	101.32	71.1	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	595.82	658.38	716.5	783.39	835.57	825.9	785.6	728.44	669.88	611.6	575.1	568.93	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.98	0.92	0.76	0.58	0.65	0.9	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.14	20.33	20.58	20.83	20.96	20.99	20.99	20.89	20.6	20.27	20.01	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.97	0.89	0.69	0.48	0.54	0.84	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.89	19.04	19.31	19.67	20.01	20.16	20.18	20.18	20.09	19.69	19.22	18.84	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.23	19.37	19.61	19.95	20.25	20.4	20.43	20.42	20.33	19.96	19.53	19.19	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.23	19.37	19.61	19.95	20.25	20.4	20.43	20.42	20.33	19.96	19.53	19.19	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.97	0.89	0.71	0.51	0.57	0.85	0.98	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	594.99	656.47	710.93	760.99	746.66	585.07	400.99	418.67	572.66	599.8	573.28	568.34	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1576.25	1527.29	1384.15	1165.89	902.64	612.34	404.03	424.78	658.09	988.39	1312.18	1582.53	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	730.06	585.19	500.87	291.53	116.05	0	0	0	0	289.11	532.01	754.56	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 3799.38 (98)

Space heating requirement in kWh/m²/year 31.56 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		3799.38	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	3989.35	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2259.46	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2372.43	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	63.62	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		77.9	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			77.9	(331)
Energy for lighting (calculated in Appendix L)				466.03	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1477.57	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	33.02	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1510.59	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1510.59	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	40.43	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	241.87	(379)
Total CO2, kg/year	sum of (376)…(382) =				1792.89	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.89	(384)
EI rating (section 14)					85.47	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-2-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	120.39	(1a) x	2.4	(2a) =	288.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	120.39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	288.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.39	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.31	0.33	0.35	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			3.68	x1/[1/(1.4)+ 0.04]		=	4.88			(27)
Windows Type 2			5.06	x1/[1/(1.4)+ 0.04]		=	6.71			(27)
Windows Type 3			3.22	x1/[1/(1.4)+ 0.04]		=	4.27			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 5			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Floor			120.39	x	0.13	=	15.6507			(28)
Walls Type1	32.79	17.48	15.31	x	0.18	=	2.76			(29)
Walls Type2	25.04	2.1	22.94	x	0.18	=	4.13			(29)
Total area of elements, m²			178.22							(31)
Party wall			61.8	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 47.81 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.9 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 58.71 (37)

TER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	56.12	55.8	55.47	53.96	53.68	52.36	52.36	52.12	52.87	53.68	54.25	54.85	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	114.83	114.5	114.18	112.67	112.39	111.07	111.07	110.83	111.58	112.39	112.96	113.56	

Average = Sum(39)$_{1…12}$ /12= 112.67 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1…12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.86 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 102.24 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	112.46	108.37	104.28	100.19	96.1	92.02	92.02	96.1	100.19	104.28	108.37	112.46	

Total = Sum(44)$_{1…12}$ = 1226.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.78	145.87	150.52	131.23	125.92	108.66	100.69	115.54	116.92	136.26	148.74	161.52	

Total = Sum(45)$_{1…12}$ = 1608.62 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.02	21.88	22.58	19.68	18.89	16.3	15.1	17.33	17.54	20.44	22.31	24.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	213.37	187.95	197.12	176.32	172.51	153.75	147.28	162.13	162.01	182.85	193.83	208.11	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	213.37	187.95	197.12	176.32	172.51	153.75	147.28	162.13	162.01	182.85	193.83	208.11

Output from water heater (annual)$_{1...12}$ | 2157.24 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.73	82.17	87.32	79.71	79.14	72.2	70.75	75.69	74.95	82.58	85.53	90.98	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	27.11	24.08	19.58	14.83	11.08	9.36	10.11	13.14	17.64	22.4	26.14	27.87	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	285.72	288.68	281.21	265.31	245.23	226.36	213.75	210.79	218.26	234.16	254.24	273.11	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	(71)

Water heating gains (Table 5)

(72)m=	124.64	122.28	117.37	110.7	106.38	100.28	95.1	101.74	104.1	111	118.79	122.29	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	506.44	504.01	487.14	459.81	431.66	404.97	387.93	394.64	408.97	436.53	468.14	492.24	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	3.68	x	10.63	x	0.63	x	0.7	=	11.96	(74)
North	0.9x	0.77	x	5.06	x	10.63	x	0.63	x	0.7	=	16.44	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	3.68	x	20.32	x	0.63	x	0.7	=	22.85	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.63	x	0.7	=	31.42	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	3.68	x	34.53	x	0.63	x	0.7	=	38.83	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.63	x	0.7	=	53.4	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	3.68	x	55.46	x	0.63	x	0.7	=	62.38	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.63	x	0.7	=	85.77	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	3.68	x	74.72	x	0.63	x	0.7	=	84.03	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.63	x	0.7	=	115.54	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	3.68	x	79.99	x	0.63	x	0.7	=	89.96	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.63	x	0.7	=	123.69	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	3.68	x	74.68	x	0.63	x	0.7	=	83.99	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.63	x	0.7	=	115.48	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	3.68	x	59.25	x	0.63	x	0.7	=	66.63	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.63	x	0.7	=	91.62	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	3.68	x	41.52	x	0.63	x	0.7	=	46.69	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.63	x	0.7	=	64.2	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	3.68	x	24.19	x	0.63	x	0.7	=	27.2	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.63	x	0.7	=	37.41	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	3.68	x	13.12	x	0.63	x	0.7	=	14.75	(74)

North	0.9x	0.77	x	5.06	x	13.12	x	0.63	x	0.7	=	20.29	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	3.68	x	8.86	x	0.63	x	0.7	=	9.97	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.63	x	0.7	=	13.71	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
South	0.9x	0.77	x	3.22	x	46.75	x	0.63	x	0.7	=	46.01	(78)
South	0.9x	0.77	x	3.22	x	76.57	x	0.63	x	0.7	=	75.35	(78)
South	0.9x	0.77	x	3.22	x	97.53	x	0.63	x	0.7	=	95.98	(78)
South	0.9x	0.77	x	3.22	x	110.23	x	0.63	x	0.7	=	108.48	(78)
South	0.9x	0.77	x	3.22	x	114.87	x	0.63	x	0.7	=	113.04	(78)
South	0.9x	0.77	x	3.22	x	110.55	x	0.63	x	0.7	=	108.79	(78)
South	0.9x	0.77	x	3.22	x	108.01	x	0.63	x	0.7	=	106.29	(78)
South	0.9x	0.77	x	3.22	x	104.89	x	0.63	x	0.7	=	103.22	(78)
South	0.9x	0.77	x	3.22	x	101.89	x	0.63	x	0.7	=	100.26	(78)
South	0.9x	0.77	x	3.22	x	82.59	x	0.63	x	0.7	=	81.27	(78)
South	0.9x	0.77	x	3.22	x	55.42	x	0.63	x	0.7	=	54.53	(78)
South	0.9x	0.77	x	3.22	x	40.4	x	0.63	x	0.7	=	39.75	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	92.35	163.91	246.46	350.2	438.66	457.37	431.74	361.42	281.19	186.69	111.7	78.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	598.79	667.92	733.61	810.01	870.32	862.33	819.67	756.06	690.16	623.22	579.85	570.62	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.98	0.92	0.76	0.59	0.65	0.9	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.05	20.25	20.54	20.8	20.96	20.99	20.99	20.88	20.55	20.2	19.92	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.12	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.97	0.89	0.68	0.48	0.54	0.85	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.68	18.85	19.15	19.57	19.93	20.12	20.15	20.14	20.04	19.59	19.07	18.66	(90)

fLA = Living area ÷ (4) = | 0.3 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.05	19.21	19.48	19.86	20.19	20.37	20.4	20.4	20.29	19.88	19.41	19.04	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.05	19.21	19.48	19.86	20.19	20.37	20.4	20.4	20.29	19.88	19.41	19.04	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.97	0.89	0.71	0.51	0.58	0.86	0.98	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	597.91	665.87	727.63	786.02	776.95	609.34	418.22	435.47	591.72	611.23	577.96	569.99	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1694.26	1638.27	1481.74	1234.88	954.6	640.84	422.03	442.95	690.68	1042.99	1390.49	1684.83	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	815.68	653.45	561.06	323.18	132.17	0	0	0	0	321.23	585.02	829.43	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4221.23 (98)

Space heating requirement in kWh/m²/year 35.06 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	815.68	653.45	561.06	323.18	132.17	0	0	0	0	321.23	585.02	829.43		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	872.39	698.88	600.07	345.64	141.36	0	0	0	0	343.56	625.69	887.1		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													4514.69	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	213.37	187.95	197.12	176.32	172.51	153.75	147.28	162.13	162.01	182.85	193.83	208.11		
Efficiency of water heater													79.8	(216)
(217)m=	88.05	87.87	87.45	86.41	84.11	79.8	79.8	79.8	79.8	86.3	87.58	88.13		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	242.33	213.9	225.4	204.05	205.09	192.67	184.56	203.17	203.02	211.87	221.32	236.14		
Total = Sum(219a)$_{1...12}$ =													2543.53	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		4514.69

Water heating fuel used			2543.53	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			478.82	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	975.17	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	549.4	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1524.58	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	248.51	(268)
Total CO2, kg/year		sum of (265)…(271) =		1812.01	(272)

TER = 15.05 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: a1-3-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.94	(1a) x	2.4	(2a) =	179.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.94	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	179.86	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.98	x1/[1/(1.2)+ 0.04]		=	6.85			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	41.4	14.26	27.14	x	0.18	=	4.89			(29)
Walls Type2	10.58	2.1	8.48	x	0.18	=	1.53			(29)
Total area of elements, m²			51.98							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.26 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.17 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 34.43 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.1	64.1	64.1	64.1	64.1	64.1	64.1	64.1	64.1	64.1	64.1	64.1	

Average = Sum(39)$_{1…12}$ /12= 64.1 (39)

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Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86

Average = Sum(40)$_{1\ldots12}$ /12= 0.86 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.36 (42)
  if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
  if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 90.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	99.27	95.66	92.05	88.44	84.83	81.22	81.22	84.83	88.44	92.05	95.66	99.27

Total = Sum(44)$_{1\ldots12}$ = 1082.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.22	128.76	132.87	115.83	111.15	95.91	88.88	101.99	103.2	120.27	131.29	142.57

Total = Sum(45)$_{1\ldots12}$ = 1419.93 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.08	19.31	19.93	17.38	16.67	14.39	13.33	15.3	15.48	18.04	19.69	21.39	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = — 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1.03 (52)

Temperature factor from Table 2b — 0.6 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = — 1.03 (54)

Enter (50) or (54) in (55) — 1.03 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.49	178.68	188.14	169.33	166.42	149.4	144.15	157.26	156.7	175.55	184.78	197.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.49	178.68	188.14	169.33	166.42	149.4	144.15	157.26	156.7	175.55	184.78	197.85

Output from water heater (annual)$_{1...12}$ 2070.77 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.17	82.75	88.4	81.31	81.18	74.69	73.77	78.13	77.11	84.21	86.45	91.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.61	16.53	13.44	10.17	7.61	6.42	6.94	9.02	12.1	15.37	17.94	19.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	208.54	210.71	205.25	193.64	178.99	165.22	156.01	153.85	159.3	170.91	185.57	199.34	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	(71)

Water heating gains (Table 5)

(72)m=	125.23	123.15	118.82	112.93	109.11	103.73	99.16	105.02	107.1	113.19	120.07	123.15	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	410.78	408.77	395.91	375.15	354.1	333.76	320.51	326.28	336.9	357.87	381.97	400.02	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.98	x	10.63	x	0.5	x	0.8	=	17.63	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	5.98	x	20.32	x	0.5	x	0.8	=	33.69	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)

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North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.98	x	34.53	x	0.5	x	0.8	=	57.24	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.98	x	55.46	x	0.5	x	0.8	=	91.94	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.98	x	74.72	x	0.5	x	0.8	=	123.85	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.98	x	79.99	x	0.5	x	0.8	=	132.59	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.98	x	74.68	x	0.5	x	0.8	=	123.79	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.98	x	59.25	x	0.5	x	0.8	=	98.21	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.98	x	41.52	x	0.5	x	0.8	=	68.82	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.98	x	24.19	x	0.5	x	0.8	=	40.1	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.98	x	13.12	x	0.5	x	0.8	=	21.74	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.98	x	8.86	x	0.5	x	0.8	=	14.69	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)

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East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	48.92	94.17	158.48	247.41	324.7	343.55	322.38	261.3	188.65	111.99	60.55	40.62	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	459.7	502.95	554.39	622.56	678.8	677.31	642.89	587.58	525.55	469.86	442.52	440.63	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.8	0.6	0.44	0.5	0.78	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.19	20.3	20.49	20.75	20.93	20.99	21	21	20.96	20.72	20.4	20.16	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.75	0.53	0.36	0.41	0.71	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.12	19.27	19.56	19.91	20.14	20.2	20.21	20.2	20.17	19.88	19.43	19.07	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.55	19.68	19.93	20.25	20.46	20.52	20.52	20.52	20.49	20.21	19.82	19.5	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.55	19.68	19.93	20.25	20.46	20.52	20.52	20.52	20.49	20.21	19.82	19.5	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.92	0.77	0.55	0.39	0.45	0.74	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	457.76	498.85	542.18	574.22	523.37	375.15	251.08	263.35	387.76	447.23	438.46	439.19	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	977.3	947.52	860.91	727.35	561.42	379.26	251.46	264.22	409.4	616.31	815.24	980.99	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	386.54	301.51	237.13	110.25	28.31	0	0	0	0	125.8	271.28	403.09	(98)

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1863.91 (98)

Space heating requirement in kWh/m²/year 24.87 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1863.91	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1957.11	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2070.77	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2174.31	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	41.31	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		48.49	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	48.49	(331)
Energy for lighting (calculated in Appendix L)		328.59	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	959.55	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	21.44	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	981	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				981	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	25.17	(378)

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CO2 associated with electricity for lighting	(332))) x	0.52	=	170.54	(379)
Total CO2, kg/year	sum of (376)…(382) =			1176.7	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.7	(384)
EI rating (section 14)				86.85	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: a1-3-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.94	(1a) x	2.4	(2a) =	179.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.94	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	179.86	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.98	x1/[1/(1.4)+ 0.04]		=	7.93			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	41.4	14.26	27.14	x	0.18	=	4.89			(29)
Walls Type2	10.58	2.1	8.48	x	0.18	=	1.53			(29)
Total area of elements, m²			51.98							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 27.42 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.73 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 32.14 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.73	35.5	35.27	34.18	33.98	33.04	33.04	32.86	33.4	33.98	34.39	34.82	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	67.87	67.64	67.41	66.33	66.12	65.18	65.18	65.01	65.54	66.12	66.53	66.96	

Average = Sum(39)$_{1\ldots12}$ /12= 66.33 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.91	0.9	0.9	0.89	0.88	0.87	0.87	0.87	0.87	0.88	0.89	0.89

Average = Sum(40)1…12 /12= 0.89 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.36 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	99.27	95.66	92.05	88.44	84.83	81.22	81.22	84.83	88.44	92.05	95.66	99.27	
											Total = Sum(44)1…12 =	1082.96	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	147.22	128.76	132.87	115.83	111.15	95.91	88.88	101.99	103.2	120.27	131.29	142.57	
											Total = Sum(45)1…12 =	1419.93	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	22.08	19.31	19.93	17.38	16.67	14.39	13.33	15.3	15.48	18.04	19.69	21.39	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	193.81	170.84	179.46	160.93	157.74	141	135.47	148.58	148.3	166.87	176.38	189.17	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	193.81	170.84	179.46	160.93	157.74	141	135.47	148.58	148.3	166.87	176.38	189.17	

Output from water heater (annual)$_{1...12}$ 1968.55 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.23	76.48	81.45	74.59	74.23	67.96	66.83	71.19	70.39	77.27	79.73	84.68	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	18.83	16.73	13.6	10.3	7.7	6.5	7.02	9.13	12.25	15.56	18.16	19.36	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	208.54	210.71	205.25	193.64	178.99	165.22	156.01	153.85	159.3	170.91	185.57	199.34	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	(71)
Water heating gains (Table 5)													
(72)m=	115.89	113.81	109.48	103.6	99.77	94.39	89.82	95.68	97.76	103.85	110.73	113.82	(72)
Total internal gains =						(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m							
(73)m=	404.67	402.64	389.74	368.94	347.86	327.51	314.26	320.06	330.72	351.72	375.86	393.91	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.98	x	10.63	x	0.63	x	0.7	=	19.43	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	5.98	x	20.32	x	0.63	x	0.7	=	37.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)

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North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	5.98	x	34.53	x	0.63	x	0.7	=	63.11	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	5.98	x	55.46	x	0.63	x	0.7	=	101.36	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	5.98	x	74.72	x	0.63	x	0.7	=	136.55	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	5.98	x	79.99	x	0.63	x	0.7	=	146.18	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	5.98	x	74.68	x	0.63	x	0.7	=	136.48	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	5.98	x	59.25	x	0.63	x	0.7	=	108.28	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	5.98	x	41.52	x	0.63	x	0.7	=	75.87	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	5.98	x	24.19	x	0.63	x	0.7	=	44.21	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	5.98	x	13.12	x	0.63	x	0.7	=	23.97	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	5.98	x	8.86	x	0.63	x	0.7	=	16.2	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)

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East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	53.94	103.83	174.73	272.77	357.98	378.76	355.42	288.08	207.98	123.47	66.76	44.78	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	458.61	506.47	564.46	641.71	705.84	706.27	669.68	608.14	538.7	475.19	442.61	438.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.94	0.8	0.58	0.43	0.49	0.78	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.23	20.45	20.74	20.93	20.99	21	21	20.96	20.7	20.36	20.1	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.17	20.17	20.18	20.18	20.19	20.19	20.2	20.19	20.18	20.18	20.17	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.75	0.51	0.35	0.4	0.71	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.15	19.46	19.87	20.12	20.19	20.19	20.19	20.16	19.83	19.35	18.96	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.43	19.58	19.85	20.22	20.44	20.51	20.52	20.52	20.48	20.18	19.75	19.41	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.43	19.58	19.85	20.22	20.44	20.51	20.52	20.52	20.48	20.18	19.75	19.41	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.92	0.76	0.54	0.38	0.44	0.73	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	456.76	502.43	552.08	590.04	538.78	381.36	254.85	266.72	395.39	452.68	438.72	437.32	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1026.87	993.06	900.24	750.73	578.09	385.19	255.21	267.55	417.87	633.46	841.88	1018.66	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	424.17	329.7	259.03	115.7	29.24	0	0	0	0	134.5	290.28	432.52	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = | 2015.14 | (98)

Space heating requirement in kWh/m²/year | 26.89 | (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system | 0 | (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	424.17	329.7	259.03	115.7	29.24	0	0	0	0	134.5	290.28	432.52		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	453.65	352.62	277.04	123.74	31.28	0	0	0	0	143.85	310.46	462.58		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2155.23	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	193.81	170.84	179.46	160.93	157.74	141	135.47	148.58	148.3	166.87	176.38	189.17		
Efficiency of water heater													79.8	(216)
(217)m=	86.85	86.54	85.79	83.95	81.3	79.8	79.8	79.8	79.8	84.25	86.13	86.95		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	223.16	197.42	209.18	191.69	194.02	176.7	169.76	186.19	185.83	198.08	204.77	217.55		
Total = Sum(219a)$_{1...12}$ =													2354.35	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2155.23	
Water heating fuel used			2354.35	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			332.62	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	465.53	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	508.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				974.07	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	172.63	(268)

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Total CO2, kg/year	sum of (265)…(271) =	1185.62	(272)
TER =		15.82	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-3-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.81	(1a) x	2.4	(2a) =	129.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.81	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	129.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			6.44	x1/[1/(1.2)+ 0.04]		=	7.37			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	19.19	9.2	9.99	x	0.18	=	1.8			(29)
Walls Type2	16.19	2.1	14.09	x	0.18	=	2.54			(29)
Total area of elements, m²			35.38							(31)
Party wall			35.3	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	17.39	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		6.62	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	24.01	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	21.31	21.31	21.31	21.31	21.31	21.31	21.31	21.31	21.31	21.31	21.31	21.31	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	45.32	45.32	45.32	45.32	45.32	45.32	45.32	45.32	45.32	45.32	45.32	45.32	

Average = Sum(39)$_{1…12}$ /12= 45.32 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84

Average = Sum(40)$_{1...12}$ /12= 0.84 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.8 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	84.71	81.63	78.55	75.47	72.39	69.31	69.31	72.39	75.47	78.55	81.63	84.71	
											Total = Sum(44)$_{1...12}$ =	924.09	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	125.62	109.87	113.37	98.84	94.84	81.84	75.84	87.02	88.06	102.63	112.03	121.66	
											Total = Sum(45)$_{1...12}$ =	1211.63	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.84	16.48	17.01	14.83	14.23	12.28	11.38	13.05	13.21	15.39	16.8	18.25	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	180.9	159.8	168.65	152.34	150.12	135.33	131.11	142.3	141.56	157.91	165.52	176.93	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	180.9	159.8	168.65	152.34	150.12	135.33	131.11	142.3	141.56	157.91	165.52	176.93

Output from water heater (annual)$_{1\ldots12}$ 1862.47 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.99	76.47	81.92	75.66	75.76	70.01	69.44	73.16	72.08	78.35	80.04	84.67	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.14	12.56	10.22	7.73	5.78	4.88	5.27	6.85	9.2	11.68	13.63	14.54	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	157.11	158.74	154.64	145.89	134.85	124.47	117.54	115.91	120.02	128.76	139.8	150.18	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	(71)

Water heating gains (Table 5)

(72)m=	115.58	113.8	110.11	105.08	101.82	97.23	93.33	98.33	100.11	105.3	111.17	113.81	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	336.87	335.14	324.99	308.74	292.49	276.62	266.18	271.13	279.36	295.79	314.65	328.56	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	6.44	x	19.64	x	0.5	x	0.8	=	35.06	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	6.44	x	38.42	x	0.5	x	0.8	=	68.59	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	6.44	x	63.27	x	0.5	x	0.8	=	112.95	(76)

East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	6.44	x	92.28	x	0.5	x	0.8	=	164.74	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	6.44	x	113.09	x	0.5	x	0.8	=	201.89	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	6.44	x	115.77	x	0.5	x	0.8	=	206.67	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	6.44	x	110.22	x	0.5	x	0.8	=	196.76	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	6.44	x	94.68	x	0.5	x	0.8	=	169.01	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	6.44	x	73.59	x	0.5	x	0.8	=	131.37	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	6.44	x	45.59	x	0.5	x	0.8	=	81.38	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	6.44	x	24.49	x	0.5	x	0.8	=	43.72	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	6.44	x	16.15	x	0.5	x	0.8	=	28.83	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	50.09	97.98	161.36	235.34	288.41	295.24	281.08	241.45	187.67	116.26	62.45	41.19	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.96	433.12	486.35	544.08	580.9	571.86	547.26	512.58	467.03	412.05	377.1	369.75	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.87	0.7	0.5	0.36	0.41	0.65	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.31	20.44	20.65	20.86	20.97	21	21	21	20.99	20.83	20.52	20.27	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.84	0.65	0.44	0.3	0.34	0.59	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.3	19.49	19.78	20.07	20.19	20.21	20.22	20.22	20.21	20.03	19.61	19.25	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.81	19.96	20.21	20.46	20.58	20.61	20.61	20.61	20.6	20.43	20.07	19.76	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.81	19.96	20.21	20.46	20.58	20.61	20.61	20.61	20.6	20.43	20.07	19.76	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.85	0.67	0.47	0.33	0.37	0.62	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	383.31	424.61	460.79	462.36	390.3	271.02	181.55	190.51	288.78	369.96	369.25	367.08	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	702.76	682.7	621.51	524.03	402.47	272.18	181.65	190.7	294.38	445.41	587.56	705.13	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	237.67	173.44	119.58	44.4	9.05	0	0	0	0	56.13	157.19	251.51	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1048.97 (98)

Space heating requirement in kWh/m²/year 19.49 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1048.97	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1101.42	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1862.47	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1955.59	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	30.57	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		34.82	(330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	34.82	(331)
Energy for lighting (calculated in Appendix L)		249.76	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	710.02	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	15.87	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	725.88	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				725.88	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	18.07	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	129.62	(379)
Total CO2, kg/year	sum of (376)…(382) =				873.58	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				16.23	(384)
EI rating (section 14)					88.15	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-3-02

Address :	Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.81	(1a) x	2.4	(2a) =	129.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.81	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	129.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			6.44	x1/[1/(1.4)+ 0.04]		=	8.54			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	19.19	9.2	9.99	x	0.18	=	1.8			(29)
Walls Type2	16.19	2.1	14.09	x	0.18	=	2.54			(29)
Total area of elements, m²			35.38							(31)
Party wall			35.3	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	18.63	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		3.07	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	21.7	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.41	25.25	25.1	24.36	24.23	23.59	23.59	23.47	23.83	24.23	24.5	24.79	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.11	46.95	46.8	46.06	45.93	45.29	45.29	45.17	45.53	45.93	46.2	46.49

Average = Sum(39)$_{1…12}$ /12= 46.06 (39)

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Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	0.88	0.87	0.87	0.86	0.85	0.84	0.84	0.84	0.85	0.85	0.86	0.86

Average = Sum(40)$_{1…12}$ /12= 0.86 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 1.8 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 77.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	84.71	81.63	78.55	75.47	72.39	69.31	69.31	72.39	75.47	78.55	81.63	84.71	

Total = Sum(44)$_{1…12}$ = 924.09 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	125.62	109.87	113.37	98.84	94.84	81.84	75.84	87.02	88.06	102.63	112.03	121.66

Total = Sum(45)$_{1…12}$ = 1211.63 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.84	16.48	17.01	14.83	14.23	12.28	11.38	13.05	13.21	15.39	16.8	18.25	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): — 1.39 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = — 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = — 0 (54)

Enter (50) or (54) in (55) — 0.75 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	172.21	151.95	159.97	143.93	141.44	126.93	122.43	133.62	133.16	149.22	157.12	168.25	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	172.21	151.95	159.97	143.93	141.44	126.93	122.43	133.62	133.16	149.22	157.12	168.25	

Output from water heater (annual)$_{1...12}$ 1760.24 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	79.04	70.2	74.97	68.94	68.81	63.29	62.49	66.21	65.35	71.4	73.32	77.73	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	14.43	12.82	10.42	7.89	5.9	4.98	5.38	6.99	9.39	11.92	13.91	14.83	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	157.11	158.74	154.64	145.89	134.85	124.47	117.54	115.91	120.02	128.76	139.8	150.18	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	(71)
Water heating gains (Table 5)													
(72)m=	106.24	104.46	100.77	95.75	92.49	87.9	83.99	88.99	90.77	95.97	101.84	104.47	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	330.82	329.06	318.87	302.57	286.27	270.39	259.95	264.93	273.21	289.69	308.59	322.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	6.44	x	19.64	x	0.63	x	0.7	=	38.65	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	6.44	x	38.42	x	0.63	x	0.7	=	75.62	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	6.44	x	63.27	x	0.63	x	0.7	=	124.53	(76)

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East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	6.44	x	92.28	x	0.63	x	0.7	=	181.62	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	6.44	x	113.09	x	0.63	x	0.7	=	222.58	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	6.44	x	115.77	x	0.63	x	0.7	=	227.85	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	6.44	x	110.22	x	0.63	x	0.7	=	216.93	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	6.44	x	94.68	x	0.63	x	0.7	=	186.34	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	6.44	x	73.59	x	0.63	x	0.7	=	144.83	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	6.44	x	45.59	x	0.63	x	0.7	=	89.73	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	6.44	x	24.49	x	0.63	x	0.7	=	48.2	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	6.44	x	16.15	x	0.63	x	0.7	=	31.79	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	55.22	108.02	177.9	259.46	317.98	325.5	309.89	266.19	206.91	128.18	68.85	45.41	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.05	437.09	496.77	562.02	604.25	595.89	569.85	531.13	480.12	417.87	377.45	367.93	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.86	0.68	0.48	0.35	0.39	0.64	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.26	20.4	20.63	20.86	20.97	21	21	21	20.99	20.82	20.5	20.24	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.19	20.19	20.19	20.21	20.21	20.22	20.22	20.22	20.21	20.21	20.2	20.2	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.83	0.63	0.43	0.29	0.32	0.57	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.21	19.41	19.73	20.06	20.18	20.22	20.22	20.22	20.2	20.02	19.57	19.18	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.73	19.91	20.18	20.46	20.58	20.61	20.61	20.61	20.6	20.42	20.04	19.71	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	19.73	19.91	20.18	20.46	20.58	20.61	20.61	20.61	20.6	20.42	20.04	19.71	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.84	0.66	0.45	0.32	0.36	0.61	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	382.63	428.66	470.25	472.46	396.56	271.13	181.47	189.98	290.68	374.41	369.82	365.41	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	727.07	704.7	640.24	532.58	407.76	272.03	181.54	190.14	295.76	451.05	597.66	721.02	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	256.26	185.5	126.47	43.28	8.33	0	0	0	0	57.02	164.05	264.57	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1105.48 (98)

Space heating requirement in kWh/m²/year 20.54 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	256.26	185.5	126.47	43.28	8.33	0	0	0	0	57.02	164.05	264.57		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	274.08	198.4	135.26	46.29	8.91	0	0	0	0	60.98	175.45	282.96		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1182.33	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)														
	172.21	151.95	159.97	143.93	141.44	126.93	122.43	133.62	133.16	149.22	157.12	168.25		
Efficiency of water heater													79.8	(216)
(217)m=	85.87	85.35	84.2	82.04	80.33	79.8	79.8	79.8	79.8	82.5	84.93	86.02		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	200.55	178.04	190	175.44	176.07	159.06	153.42	167.44	166.86	180.89	185	195.6		
Total = Sum(219a)$_{1...12}$ =													2128.38	(219)

Annual totals **kWh/year** **kWh/year**

Space heating fuel used, main system 1 1182.33

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Water heating fuel used			2128.38	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			254.86	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	255.38	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	459.73	(264)
Space and water heating	(261) + (262) + (263) + (264) =				715.11	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	132.27	(268)
Total CO2, kg/year			sum of (265)…(271) =		886.31	(272)

TER = 16.47 (273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-3-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.35	(1a) x	2.4	(2a) =	176.04	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.35	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.04	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.06	x1/[1/(1.2)+ 0.04]		=	5.79			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	41.75	10.58	31.17	x	0.18	=	5.61			(29)
Walls Type2	13.03	2.1	10.93	x	0.18	=	1.97			(29)
Total area of elements, m²			54.78							(31)
Party wall			28.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 22.21 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.43 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 30.64 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.05	29.05	29.05	29.05	29.05	29.05	29.05	29.05	29.05	29.05	29.05	29.05	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	59.69	59.69	59.69	59.69	59.69	59.69	59.69	59.69	59.69	59.69	59.69	59.69	

Average = Sum(39)$_{1…12}$ /12= 59.69 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81

Average = Sum(40)$_{1…12}$ /12= 0.81 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.32 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.41 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	98.35	94.77	91.2	87.62	84.05	80.47	80.47	84.05	87.62	91.2	94.77	98.35

Total = Sum(44)$_{1…12}$ = 1072.92 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.85	127.56	131.63	114.76	110.12	95.02	88.05	101.04	102.25	119.16	130.07	141.25

Total = Sum(45)$_{1…12}$ = 1406.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.88	19.13	19.75	17.21	16.52	14.25	13.21	15.16	15.34	17.87	19.51	21.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.13	177.49	186.91	168.25	165.39	148.52	143.33	156.32	155.74	174.44	183.57	196.53	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.13	177.49	186.91	168.25	165.39	148.52	143.33	156.32	155.74	174.44	183.57	196.53	

Output from water heater (annual)$_{1...12}$ 2057.61 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.72	82.36	87.99	80.95	80.84	74.39	73.5	77.82	76.79	83.84	86.04	91.19	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.96	16.84	13.69	10.37	7.75	6.54	7.07	9.19	12.33	15.66	18.28	19.48	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	204.99	207.11	201.75	190.34	175.94	162.4	153.35	151.23	156.59	168	182.4	195.94	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	(71)

Water heating gains (Table 5)

(72)m=	124.62	122.55	118.27	112.43	108.65	103.32	98.79	104.59	106.66	112.69	119.51	122.56	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	406.43	404.37	391.58	371.01	350.2	330.13	317.08	322.88	333.44	354.22	378.05	395.86	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.06	x	19.64	x	0.5	x	0.8	=	27.55	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	5.06	x	38.42	x	0.5	x	0.8	=	53.89	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	5.06	x	63.27	x	0.5	x	0.8	=	88.75	(76)

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East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	5.06	x	92.28	x	0.5	x	0.8	=	129.44	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	5.06	x	113.09	x	0.5	x	0.8	=	158.63	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	5.06	x	115.77	x	0.5	x	0.8	=	162.38	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	5.06	x	110.22	x	0.5	x	0.8	=	154.6	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	5.06	x	94.68	x	0.5	x	0.8	=	132.8	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	5.06	x	73.59	x	0.5	x	0.8	=	103.22	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	5.06	x	45.59	x	0.5	x	0.8	=	63.94	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	5.06	x	24.49	x	0.5	x	0.8	=	34.35	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	5.06	x	16.15	x	0.5	x	0.8	=	22.65	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	78.34	141.86	211.78	284.37	333.04	335.53	321.56	285.48	237.47	162.01	95.48	65.92	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	484.77	546.24	603.36	655.39	683.24	665.66	638.64	608.36	570.91	516.22	473.54	461.78	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.91	0.76	0.57	0.41	0.45	0.7	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.3	20.43	20.62	20.83	20.96	20.99	21	21	20.98	20.81	20.51	20.26	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.88	0.72	0.5	0.34	0.38	0.63	0.91	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.3	19.49	19.76	20.05	20.2	20.24	20.24	20.24	20.23	20.03	19.61	19.25	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.7	19.86	20.11	20.36	20.5	20.54	20.54	20.54	20.53	20.34	19.97	19.65	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.7	19.86	20.11	20.36	20.5	20.54	20.54	20.54	20.53	20.34	19.97	19.65	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.96	0.89	0.73	0.53	0.37	0.41	0.66	0.92	0.98	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	481.58	538.14	579.69	581.81	501.28	352.12	235.26	247.01	374.48	472.69	466.21	459.51	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	919.34	893.22	812.11	683.95	525.43	354.59	235.45	247.37	383.74	581.63	768.06	922.37	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	325.69	238.61	172.92	73.54	17.97	0	0	0	0	81.05	217.33	344.37	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1471.49 (98)

Space heating requirement in kWh/m²/year 20.06 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1471.49	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1545.06	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308

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Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2057.61	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2160.49	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	37.06	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.46	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	47.46	(331)
Energy for lighting (calculated in Appendix L)		334.76	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	860.64	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	19.23	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	879.88	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				879.88	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	24.63	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	173.74	(379)
Total CO2, kg/year	sum of (376)…(382) =				1078.25	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.7	(384)
EI rating (section 14)					87.79	(385)

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User Details:

Assessor Name: **Stroma Number:**
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.8

Property Address: a1-3-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.35	(1a) x	2.4	(2a) =	176.04	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.35	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.04	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.06	x1/[1/(1.4)+ 0.04]		=	6.71			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	41.75	10.58	31.17	x	0.18	=	5.61			(29)
Walls Type2	13.03	2.1	10.93	x	0.18	=	1.97			(29)
Total area of elements, m²			54.78							(31)
Party wall			28.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 23.7 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.39 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 28.1 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.08	34.84	34.61	33.53	33.33	32.39	32.39	32.22	32.76	33.33	33.74	34.17	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	63.17	62.94	62.71	61.63	61.43	60.49	60.49	60.32	60.85	61.43	61.84	62.26	

Average = Sum(39)$_{1…12}$ /12= 61.63 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(40)m=	0.86	0.86	0.85	0.84	0.84	0.82	0.82	0.82	0.83	0.84	0.84	0.85		
											Average = Sum(40)$_{1…12}$ /12=		0.84	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.32 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.41 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)														
(44)m=	98.35	94.77	91.2	87.62	84.05	80.47	80.47	84.05	87.62	91.2	94.77	98.35		
											Total = Sum(44)$_{1…12}$ =		1072.92	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)														
(45)m=	145.85	127.56	131.63	114.76	110.12	95.02	88.05	101.04	102.25	119.16	130.07	141.25		
											Total = Sum(45)$_{1…12}$ =		1406.77	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)														
(46)m=	21.88	19.13	19.75	17.21	16.52	14.25	13.21	15.16	15.34	17.87	19.51	21.19		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	192.45	169.65	178.23	159.85	156.71	140.11	134.65	147.64	147.34	165.75	175.16	187.84	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	192.45	169.65	178.23	159.85	156.71	140.11	134.65	147.64	147.34	165.75	175.16	187.84	

Output from water heater (annual)$_{1...12}$ 1955.39 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.77	76.08	81.04	74.23	73.89	67.67	66.55	70.87	70.07	76.9	79.32	84.24	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	19.48	17.3	14.07	10.65	7.96	6.72	7.26	9.44	12.67	16.09	18.78	20.02	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	204.99	207.11	201.75	190.34	175.94	162.4	153.35	151.23	156.59	168	182.4	195.94	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	(71)
Water heating gains (Table 5)													
(72)m=	115.28	113.22	108.93	103.1	99.31	93.98	89.45	95.26	97.32	103.36	110.17	113.23	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	400.62	398.5	385.62	364.96	344.08	323.97	310.94	316.8	327.45	348.31	372.22	390.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.06	x	19.64	x	0.63	x	0.7	=	30.37	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	5.06	x	38.42	x	0.63	x	0.7	=	59.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	5.06	x	63.27	x	0.63	x	0.7	=	97.85	(76)

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East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	5.06	x	92.28	x	0.63	x	0.7	=	142.7	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	5.06	x	113.09	x	0.63	x	0.7	=	174.89	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	5.06	x	115.77	x	0.63	x	0.7	=	179.03	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	5.06	x	110.22	x	0.63	x	0.7	=	170.44	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	5.06	x	94.68	x	0.63	x	0.7	=	146.41	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	5.06	x	73.59	x	0.63	x	0.7	=	113.8	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	5.06	x	45.59	x	0.63	x	0.7	=	70.5	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	5.06	x	24.49	x	0.63	x	0.7	=	37.87	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	5.06	x	16.15	x	0.63	x	0.7	=	24.98	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.37	156.41	233.49	313.52	367.17	369.93	354.52	314.74	261.81	178.61	105.27	72.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	486.99	554.91	619.11	678.48	711.26	693.9	665.46	631.54	589.26	526.93	477.49	462.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.76	0.55	0.4	0.44	0.69	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.37	20.58	20.82	20.95	21	21	21	20.98	20.8	20.48	20.21	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.21	20.22	20.22	20.23	20.23	20.23	20.23	20.22	20.22	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.88	0.71	0.49	0.33	0.37	0.62	0.91	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.17	19.38	19.68	20.02	20.18	20.23	20.23	20.23	20.21	20	19.54	19.15	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.59	19.78	20.04	20.34	20.49	20.54	20.54	20.54	20.52	20.32	19.91	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.59	19.78	20.04	20.34	20.49	20.54	20.54	20.54	20.52	20.32	19.91	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.96	0.88	0.72	0.51	0.36	0.39	0.65	0.91	0.98	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	483.91	546.78	594.68	598.99	515.33	356.8	238.09	249.38	381.49	482.05	470.25	460.53	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	966.21	936.37	849.3	704.95	539.95	359.03	238.26	249.7	390.71	597.15	792.42	957.11	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	358.83	261.81	189.43	76.29	18.31	0	0	0	0	85.64	231.97	369.46	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1591.74 (98)

Space heating requirement in kWh/m²/year 21.7 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	358.83	261.81	189.43	76.29	18.31	0	0	0	0	85.64	231.97	369.46	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	383.77	280.01	202.6	81.6	19.59	0	0	0	0	91.59	248.09	395.14	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1702.39 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

192.45	169.65	178.23	159.85	156.71	140.11	134.65	147.64	147.34	165.75	175.16	187.84

Efficiency of water heater 79.8 (216)

(217)m=	86.45	85.97	84.98	82.97	80.8	79.8	79.8	79.8	79.8	83.15	85.56	86.59	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	222.6	197.34	209.74	192.67	193.95	175.58	168.73	185.01	184.64	199.35	204.72	216.94

Total = Sum(219a)$_{1...12}$ = 2351.26 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1702.39	
Water heating fuel used		2351.26	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		344.01	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	367.72	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	507.87	(264)
Space and water heating	(261) + (262) + (263) + (264) =			875.59	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	178.54	(268)
Total CO2, kg/year		sum of (265)…(271) =		1093.05	(272)

TER = 14.9 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-3-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	72.42	(1a) x	2.4	(2a) =	173.81	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.42	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	173.81	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.98	x1/[1/(1.2)+ 0.04]		=	6.85			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	46.63	16.1	30.53	x	0.18	=	5.5			(29)
Walls Type2	26.01	2.1	23.91	x	0.18	=	4.3			(29)
Total area of elements, m²			72.64							(31)
Party wall			20.62	x	0	=	0			(32)

* *for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

** *include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.75 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.55 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 41.3 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	69.98	69.98	69.98	69.98	69.98	69.98	69.98	69.98	69.98	69.98	69.98	69.98

Average = Sum(39)$_{1…12}$ /12= 69.98 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97

Average = Sum(40)$_{1…12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.3 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.91 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.8	94.24	90.68	87.13	83.57	80.02	80.02	83.57	87.13	90.68	94.24	97.8

Total = Sum(44)$_{1…12}$ = 1066.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.03	126.84	130.89	114.11	109.5	94.49	87.56	100.47	101.67	118.49	129.34	140.45

Total = Sum(45)$_{1…12}$ = 1398.84 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.75	19.03	19.63	17.12	16.42	14.17	13.13	15.07	15.25	17.77	19.4	21.07	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	200.31	176.77	186.17	167.61	164.77	147.98	142.83	155.75	155.16	173.76	182.83	195.73	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	200.31	176.77	186.17	167.61	164.77	147.98	142.83	155.75	155.16	173.76	182.83	195.73	

Output from water heater (annual)$_{1...12}$	2049.68	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.44	82.12	87.74	80.74	80.63	74.21	73.33	77.63	76.6	83.62	85.8	90.92	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	18.09	16.06	13.06	9.89	7.39	6.24	6.74	8.77	11.77	14.94	17.44	18.59	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	202.88	204.98	199.68	188.38	174.13	160.73	151.78	149.67	154.98	166.27	180.53	193.93	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	(71)
Water heating gains (Table 5)													
(72)m=	124.25	122.2	117.93	112.14	108.37	103.07	98.57	104.34	106.39	112.39	119.17	122.21	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	402.77	400.8	388.23	367.96	347.44	327.59	314.64	320.33	330.68	351.15	374.68	392.27	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	5.98	x	46.75	x	0.5	x	0.8	=	77.5	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)

South	0.9x	0.77	x	5.98	x	76.57	x	0.5	x	0.8	=	126.92	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	5.98	x	97.53	x	0.5	x	0.8	=	161.68	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	5.98	x	110.23	x	0.5	x	0.8	=	182.73	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	5.98	x	114.87	x	0.5	x	0.8	=	190.42	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	5.98	x	110.55	x	0.5	x	0.8	=	183.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	5.98	x	108.01	x	0.5	x	0.8	=	179.05	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	5.98	x	104.89	x	0.5	x	0.8	=	173.88	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	5.98	x	101.89	x	0.5	x	0.8	=	168.89	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	5.98	x	82.59	x	0.5	x	0.8	=	136.9	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	5.98	x	55.42	x	0.5	x	0.8	=	91.86	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	5.98	x	40.4	x	0.5	x	0.8	=	66.97	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)

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West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	153.34	263.89	365.39	455.34	509.03	504.02	486.55	447.29	396.98	293.09	184.22	130.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	556.11	664.69	753.62	823.3	856.48	831.61	801.19	767.62	727.66	644.25	558.91	523.1	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.86	0.72	0.53	0.38	0.42	0.64	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.17	20.36	20.6	20.82	20.95	20.99	21	21	20.98	20.8	20.43	20.12	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.83	0.66	0.46	0.31	0.34	0.57	0.87	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.02	19.29	19.62	19.91	20.07	20.11	20.11	20.11	20.1	19.9	19.39	18.94	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.48	19.72	20.01	20.28	20.42	20.46	20.47	20.47	20.45	20.26	19.81	19.42	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.48	19.72	20.01	20.28	20.42	20.46	20.47	20.47	20.45	20.26	19.81	19.42	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.93	0.84	0.68	0.49	0.34	0.37	0.6	0.87	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	549.79	645.6	701.28	689.97	582.83	406.64	270.23	283.95	434.01	562.09	544.18	518.72	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1062.34	1037.11	945.47	796.11	610.2	410.14	270.56	284.53	444.32	676.03	889.38	1064.73	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	381.34	263.09	181.68	76.42	20.36	0	0	0	0	84.77	248.54	406.23

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1662.44	(98)
Space heating requirement in kWh/m²/year	22.96	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1662.44	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1745.56	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2049.68	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2152.16	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	38.98	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.86	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	46.86	(331)

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Energy for lighting (calculated in Appendix L)				319.42	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	= 905.28	(367)
Electrical energy for heat distribution	[(313) x		0.52	= 20.23	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			= 925.51	(373)
CO2 associated with space heating (secondary)	(309) x		0	= 0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	= 0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			925.51	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	= 24.32	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	= 165.78	(379)
Total CO2, kg/year	sum of (376)…(382) =			1115.61	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.4	(384)
EI rating (section 14)				87.27	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-3-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	72.42	(1a) x	2.4	(2a) =	173.81	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.42	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	173.81	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.94	x1/[1/(1.4)+ 0.04]		=	7.87			(27)
Windows Type 2			2.74	x1/[1/(1.4)+ 0.04]		=	3.63			(27)
Windows Type 3			2.74	x1/[1/(1.4)+ 0.04]		=	3.63			(27)
Windows Type 4			1.83	x1/[1/(1.4)+ 0.04]		=	2.43			(27)
Windows Type 5			2.74	x1/[1/(1.4)+ 0.04]		=	3.63			(27)
Walls Type1	46.63	15.99	30.64	x	0.18	=	5.52			(29)
Walls Type2	26.01	2.1	23.91	x	0.18	=	4.3			(29)
Total area of elements, m²			72.64							(31)
Party wall			20.62	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.12 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.99 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 39.1 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	34.69	34.46	34.23	33.16	32.95	32.02	32.02	31.84	32.38	32.95	33.36	33.79	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.8	73.56	73.34	72.26	72.06	71.12	71.12	70.95	71.48	72.06	72.47	72.89	

Average = Sum(39)1…12 /12= 72.26 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.02	1.02	1.01	1	1	0.98	0.98	0.98	0.99	1	1	1.01

Average = Sum(40)1…12 /12= 1 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.3 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.91 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	97.8	94.24	90.68	87.13	83.57	80.02	80.02	83.57	87.13	90.68	94.24	97.8

Total = Sum(44)1…12 = 1066.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.03	126.84	130.89	114.11	109.5	94.49	87.56	100.47	101.67	118.49	129.34	140.45

Total = Sum(45)1…12 = 1398.84 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.75	19.03	19.63	17.12	16.42	14.17	13.13	15.07	15.25	17.77	19.4	21.07	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.62	168.93	177.49	159.21	156.09	139.58	134.15	147.07	146.76	165.08	174.43	187.05	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.62	168.93	177.49	159.21	156.09	139.58	134.15	147.07	146.76	165.08	174.43	187.05

Output from water heater (annual)$_{1...12}$	1947.46	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.5	75.84	80.8	74.02	73.68	67.49	66.39	70.68	69.88	76.67	79.08	83.98	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.09	16.07	13.07	9.89	7.4	6.24	6.75	8.77	11.77	14.94	17.44	18.59	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	202.88	204.98	199.68	188.38	174.13	160.73	151.78	149.67	154.98	166.27	180.53	193.93	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	(71)

Water heating gains (Table 5)

(72)m=	114.92	112.86	108.6	102.8	99.04	93.74	89.23	95	97.05	103.06	109.83	112.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	396.44	394.47	381.9	361.63	341.11	321.26	308.31	313.99	324.35	344.82	368.35	385.94	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	5.94	x	46.75	x	0.63	x	0.7	=	84.87	(78)
South	0.9x	0.77	x	2.74	x	46.75	x	0.63	x	0.7	=	39.15	(78)

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South	0.9x	0.77	x	5.94	x	76.57	x	0.63	x	0.7	=	139	(78)
South	0.9x	0.77	x	2.74	x	76.57	x	0.63	x	0.7	=	64.12	(78)
South	0.9x	0.77	x	5.94	x	97.53	x	0.63	x	0.7	=	177.06	(78)
South	0.9x	0.77	x	2.74	x	97.53	x	0.63	x	0.7	=	81.67	(78)
South	0.9x	0.77	x	5.94	x	110.23	x	0.63	x	0.7	=	200.11	(78)
South	0.9x	0.77	x	2.74	x	110.23	x	0.63	x	0.7	=	92.31	(78)
South	0.9x	0.77	x	5.94	x	114.87	x	0.63	x	0.7	=	208.53	(78)
South	0.9x	0.77	x	2.74	x	114.87	x	0.63	x	0.7	=	96.19	(78)
South	0.9x	0.77	x	5.94	x	110.55	x	0.63	x	0.7	=	200.68	(78)
South	0.9x	0.77	x	2.74	x	110.55	x	0.63	x	0.7	=	92.57	(78)
South	0.9x	0.77	x	5.94	x	108.01	x	0.63	x	0.7	=	196.08	(78)
South	0.9x	0.77	x	2.74	x	108.01	x	0.63	x	0.7	=	90.45	(78)
South	0.9x	0.77	x	5.94	x	104.89	x	0.63	x	0.7	=	190.42	(78)
South	0.9x	0.77	x	2.74	x	104.89	x	0.63	x	0.7	=	87.84	(78)
South	0.9x	0.77	x	5.94	x	101.89	x	0.63	x	0.7	=	184.96	(78)
South	0.9x	0.77	x	2.74	x	101.89	x	0.63	x	0.7	=	85.32	(78)
South	0.9x	0.77	x	5.94	x	82.59	x	0.63	x	0.7	=	149.92	(78)
South	0.9x	0.77	x	2.74	x	82.59	x	0.63	x	0.7	=	69.16	(78)
South	0.9x	0.77	x	5.94	x	55.42	x	0.63	x	0.7	=	100.6	(78)
South	0.9x	0.77	x	2.74	x	55.42	x	0.63	x	0.7	=	46.41	(78)
South	0.9x	0.77	x	5.94	x	40.4	x	0.63	x	0.7	=	73.34	(78)
South	0.9x	0.77	x	2.74	x	40.4	x	0.63	x	0.7	=	33.83	(78)
West	0.9x	0.77	x	2.74	x	19.64	x	0.63	x	0.7	=	16.45	(80)
West	0.9x	0.77	x	1.83	x	19.64	x	0.63	x	0.7	=	10.98	(80)
West	0.9x	0.77	x	2.74	x	19.64	x	0.63	x	0.7	=	16.45	(80)
West	0.9x	0.77	x	2.74	x	38.42	x	0.63	x	0.7	=	32.17	(80)
West	0.9x	0.77	x	1.83	x	38.42	x	0.63	x	0.7	=	21.49	(80)
West	0.9x	0.77	x	2.74	x	38.42	x	0.63	x	0.7	=	32.17	(80)
West	0.9x	0.77	x	2.74	x	63.27	x	0.63	x	0.7	=	52.98	(80)
West	0.9x	0.77	x	1.83	x	63.27	x	0.63	x	0.7	=	35.39	(80)
West	0.9x	0.77	x	2.74	x	63.27	x	0.63	x	0.7	=	52.98	(80)
West	0.9x	0.77	x	2.74	x	92.28	x	0.63	x	0.7	=	77.27	(80)
West	0.9x	0.77	x	1.83	x	92.28	x	0.63	x	0.7	=	51.61	(80)
West	0.9x	0.77	x	2.74	x	92.28	x	0.63	x	0.7	=	77.27	(80)
West	0.9x	0.77	x	2.74	x	113.09	x	0.63	x	0.7	=	94.7	(80)
West	0.9x	0.77	x	1.83	x	113.09	x	0.63	x	0.7	=	63.25	(80)
West	0.9x	0.77	x	2.74	x	113.09	x	0.63	x	0.7	=	94.7	(80)
West	0.9x	0.77	x	2.74	x	115.77	x	0.63	x	0.7	=	96.94	(80)
West	0.9x	0.77	x	1.83	x	115.77	x	0.63	x	0.7	=	64.75	(80)
West	0.9x	0.77	x	2.74	x	115.77	x	0.63	x	0.7	=	96.94	(80)
West	0.9x	0.77	x	2.74	x	110.22	x	0.63	x	0.7	=	92.29	(80)

West	0.9x	0.77	x	1.83	x	110.22	x	0.63	x	0.7	=	61.64	(80)
West	0.9x	0.77	x	2.74	x	110.22	x	0.63	x	0.7	=	92.29	(80)
West	0.9x	0.77	x	2.74	x	94.68	x	0.63	x	0.7	=	79.28	(80)
West	0.9x	0.77	x	1.83	x	94.68	x	0.63	x	0.7	=	52.95	(80)
West	0.9x	0.77	x	2.74	x	94.68	x	0.63	x	0.7	=	79.28	(80)
West	0.9x	0.77	x	2.74	x	73.59	x	0.63	x	0.7	=	61.62	(80)
West	0.9x	0.77	x	1.83	x	73.59	x	0.63	x	0.7	=	41.16	(80)
West	0.9x	0.77	x	2.74	x	73.59	x	0.63	x	0.7	=	61.62	(80)
West	0.9x	0.77	x	2.74	x	45.59	x	0.63	x	0.7	=	38.18	(80)
West	0.9x	0.77	x	1.83	x	45.59	x	0.63	x	0.7	=	25.5	(80)
West	0.9x	0.77	x	2.74	x	45.59	x	0.63	x	0.7	=	38.18	(80)
West	0.9x	0.77	x	2.74	x	24.49	x	0.63	x	0.7	=	20.51	(80)
West	0.9x	0.77	x	1.83	x	24.49	x	0.63	x	0.7	=	13.7	(80)
West	0.9x	0.77	x	2.74	x	24.49	x	0.63	x	0.7	=	20.51	(80)
West	0.9x	0.77	x	2.74	x	16.15	x	0.63	x	0.7	=	13.52	(80)
West	0.9x	0.77	x	1.83	x	16.15	x	0.63	x	0.7	=	9.03	(80)
West	0.9x	0.77	x	2.74	x	16.15	x	0.63	x	0.7	=	13.52	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	167.9	288.95	400.08	498.58	557.37	551.89	532.76	489.76	434.67	320.92	201.72	143.25	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	564.33	683.41	781.98	860.21	898.48	873.15	841.06	803.76	759.03	665.75	570.07	529.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.86	0.7	0.52	0.37	0.4	0.63	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.32	20.57	20.82	20.95	20.99	21	21	20.98	20.8	20.4	20.07	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.07	20.07	20.07	20.09	20.09	20.1	20.1	20.1	20.09	20.09	20.08	20.08	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.82	0.65	0.45	0.3	0.33	0.55	0.86	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.89	19.19	19.55	19.89	20.04	20.09	20.1	20.1	20.08	19.87	19.33	18.85	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.38	19.64	19.96	20.26	20.41	20.45	20.46	20.46	20.44	20.24	19.76	19.34	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.38	19.64	19.96	20.26	20.41	20.45	20.46	20.46	20.44	20.24	19.76	19.34	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.93	0.83	0.67	0.47	0.33	0.36	0.58	0.87	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	557.8	663.01	725.31	712.91	599.97	413.13	274.11	287.48	443.14	577.31	554.57	524.65	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1112.68	1084.47	986.9	820.78	627.32	416.32	274.42	288	453.16	694.7	917.45	1103.25	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	412.83	283.22	194.62	77.66	20.35	0	0	0	0	87.34	261.27	430.47

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1767.78 (98)

Space heating requirement in kWh/m²/year 24.41 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	412.83	283.22	194.62	77.66	20.35	0	0	0	0	87.34	261.27	430.47	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	441.53	302.91	208.15	83.06	21.76	0	0	0	0	93.41	279.44	460.4	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1890.68 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	191.62	168.93	177.49	159.21	156.09	139.58	134.15	147.07	146.76	165.08	174.43	187.05

Efficiency of water heater 79.8 (216)

(217)m=	86.81	86.18	85.06	83.02	80.9	79.8	79.8	79.8	79.8	83.2	85.89	86.97	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	220.74	196.01	208.66	191.77	192.93	174.91	168.11	184.29	183.91	198.41	203.09	215.08

Total = Sum(219a)$_{1...12}$ = 2337.92 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1890.68
Water heating fuel used		2337.92
Electricity for pumps, fans and electric keep-hot		

central heating pump:		30	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		319.49	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	408.39	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	504.99	(264)
Space and water heating	(261) + (262) + (263) + (264) =				913.38	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	165.82	(268)
Total CO2, kg/year			sum of (265)…(271) =		1118.12	(272)

TER = 15.44 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-3-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	120.39	(1a) x	2.4	(2a) =	288.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	120.39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	288.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.06	x1/[1/(1.2)+ 0.04]		=	5.79			(27)
Windows Type 2			3.68	x1/[1/(1.2)+ 0.04]		=	4.21			(27)
Windows Type 3			3.22	x1/[1/(1.2)+ 0.04]		=	3.69			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	32.79	17.48	15.31	x	0.18	=	2.76			(29)
Walls Type2	25.04	2.1	22.94	x	0.18	=	4.13			(29)
Total area of elements, m²			57.83							(31)
Party wall			61.8	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 29.42 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.98 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 41.4 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	89.07	89.07	89.07	89.07	89.07	89.07	89.07	89.07	89.07	89.07	89.07	89.07	

Average = Sum(39)$_{1…12}$ /12= 89.07 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	

Average = Sum(40)$_{1…12}$ /12= 0.74 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.86 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 102.24 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	112.46	108.37	104.28	100.19	96.1	92.02	92.02	96.1	100.19	104.28	108.37	112.46	

Total = Sum(44)$_{1…12}$ = 1226.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.78	145.87	150.52	131.23	125.92	108.66	100.69	115.54	116.92	136.26	148.74	161.52	

Total = Sum(45)$_{1…12}$ = 1608.62 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.02	21.88	22.58	19.68	18.89	16.3	15.1	17.33	17.54	20.44	22.31	24.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	222.06	195.79	205.8	184.72	181.19	162.15	155.96	170.82	170.41	191.53	202.23	216.79	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	222.06	195.79	205.8	184.72	181.19	162.15	155.96	170.82	170.41	191.53	202.23	216.79	

Output from water heater (annual)$_{1…12}$	2259.46	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	99.68	88.44	94.27	86.43	86.09	78.92	77.7	82.64	81.67	89.53	92.25	97.93	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	26.39	23.44	19.06	14.43	10.79	9.11	9.84	12.79	17.17	21.8	25.44	27.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	285.72	288.68	281.21	265.31	245.23	226.36	213.75	210.79	218.26	234.16	254.24	273.11	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	(71)

Water heating gains (Table 5)

(72)m=	133.97	131.61	126.71	120.04	115.71	109.62	104.43	111.07	113.43	120.33	128.12	131.62	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	512.05	509.71	492.95	465.75	437.7	411.05	394	400.62	414.83	442.27	473.78	497.83	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.06	x	10.63	x	0.5	x	0.8	=	14.91	(74)
North	0.9x	0.77	x	3.68	x	10.63	x	0.5	x	0.8	=	10.85	(74)

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North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.5	x	0.8	=	28.5	(74)
North	0.9x	0.77	x	3.68	x	20.32	x	0.5	x	0.8	=	20.73	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.5	x	0.8	=	48.43	(74)
North	0.9x	0.77	x	3.68	x	34.53	x	0.5	x	0.8	=	35.22	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.5	x	0.8	=	77.8	(74)
North	0.9x	0.77	x	3.68	x	55.46	x	0.5	x	0.8	=	56.58	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.5	x	0.8	=	104.8	(74)
North	0.9x	0.77	x	3.68	x	74.72	x	0.5	x	0.8	=	76.22	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.5	x	0.8	=	112.19	(74)
North	0.9x	0.77	x	3.68	x	79.99	x	0.5	x	0.8	=	81.59	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.5	x	0.8	=	104.74	(74)
North	0.9x	0.77	x	3.68	x	74.68	x	0.5	x	0.8	=	76.18	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.5	x	0.8	=	83.1	(74)
North	0.9x	0.77	x	3.68	x	59.25	x	0.5	x	0.8	=	60.44	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.5	x	0.8	=	58.23	(74)
North	0.9x	0.77	x	3.68	x	41.52	x	0.5	x	0.8	=	42.35	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.5	x	0.8	=	33.93	(74)
North	0.9x	0.77	x	3.68	x	24.19	x	0.5	x	0.8	=	24.68	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.06	x	13.12	x	0.5	x	0.8	=	18.4	(74)
North	0.9x	0.77	x	3.68	x	13.12	x	0.5	x	0.8	=	13.38	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)

North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.5	x	0.8	=	12.43	(74)
North	0.9x	0.77	x	3.68	x	8.86	x	0.5	x	0.8	=	9.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
South	0.9x	0.77	x	3.22	x	46.75	x	0.5	x	0.8	=	41.73	(78)
South	0.9x	0.77	x	3.22	x	76.57	x	0.5	x	0.8	=	68.34	(78)
South	0.9x	0.77	x	3.22	x	97.53	x	0.5	x	0.8	=	87.06	(78)
South	0.9x	0.77	x	3.22	x	110.23	x	0.5	x	0.8	=	98.39	(78)
South	0.9x	0.77	x	3.22	x	114.87	x	0.5	x	0.8	=	102.53	(78)
South	0.9x	0.77	x	3.22	x	110.55	x	0.5	x	0.8	=	98.67	(78)
South	0.9x	0.77	x	3.22	x	108.01	x	0.5	x	0.8	=	96.41	(78)
South	0.9x	0.77	x	3.22	x	104.89	x	0.5	x	0.8	=	93.63	(78)
South	0.9x	0.77	x	3.22	x	101.89	x	0.5	x	0.8	=	90.94	(78)
South	0.9x	0.77	x	3.22	x	82.59	x	0.5	x	0.8	=	73.71	(78)
South	0.9x	0.77	x	3.22	x	55.42	x	0.5	x	0.8	=	49.46	(78)
South	0.9x	0.77	x	3.22	x	40.4	x	0.5	x	0.8	=	36.06	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	83.76	148.67	223.55	317.64	397.87	414.85	391.6	327.82	255.05	169.33	101.32	71.1	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	595.82	658.38	716.5	783.39	835.57	825.9	785.6	728.44	669.88	611.6	575.1	568.93	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.88	0.68	0.5	0.56	0.84	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.25	20.34	20.51	20.73	20.92	20.99	21	21	20.96	20.73	20.44	20.22	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.31	20.31	20.31	20.31	20.31	20.31	20.31	20.31	20.31	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.96	0.84	0.61	0.42	0.48	0.78	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.28	19.42	19.66	19.98	20.22	20.3	20.31	20.3	20.27	19.97	19.56	19.24	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.57	19.7	19.92	20.21	20.43	20.51	20.51	20.51	20.47	20.2	19.83	19.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.57	19.7	19.92	20.21	20.43	20.51	20.51	20.51	20.47	20.2	19.83	19.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.96	0.85	0.63	0.44	0.5	0.8	0.97	1	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	594.98	656.23	709.4	751.23	706.19	518.63	348.04	365.07	532.79	595.27	573.03	568.35	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1360.18	1318.19	1195.23	1007.07	777.78	526.04	348.58	366.32	567.79	855.08	1133.45	1365.55	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	569.31	444.83	361.46	184.2	53.26	0	0	0	0	193.3	403.5	593.12

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2802.98 (98)

Space heating requirement in kWh/m²/year 23.28 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2802.98	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2943.12	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2259.46	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2372.43	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	53.16	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		77.9	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	77.9	(331)

Energy for lighting (calculated in Appendix L)				466.03	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	= 1234.58	(367)
Electrical energy for heat distribution	[(313) x		0.52	= 27.59	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			= 1262.17	(373)
CO2 associated with space heating (secondary)	(309) x		0	= 0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	= 0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1262.17	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	= 40.43	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	= 241.87	(379)
Total CO2, kg/year	sum of (376)…(382) =			1544.47	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			12.83	(384)
EI rating (section 14)				87.49	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-3-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	120.39	(1a) x	2.4	(2a) =	288.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	120.39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	288.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.39	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.31	0.33	0.35	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.06	x1/[1/(1.4)+ 0.04]		=	6.71			(27)
Windows Type 2			3.68	x1/[1/(1.4)+ 0.04]		=	4.88			(27)
Windows Type 3			3.22	x1/[1/(1.4)+ 0.04]		=	4.27			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 5			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	32.79	17.48	15.31	x	0.18	=	2.76			(29)
Walls Type2	25.04	2.1	22.94	x	0.18	=	4.13			(29)
Total area of elements, m²			57.83							(31)
Party wall			61.8	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	32.16	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		4.95	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	37.11	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	56.12	55.8	55.47	53.96	53.68	52.36	52.36	52.12	52.87	53.68	54.25	54.85	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	93.23	92.91	92.58	91.07	90.79	89.48	89.48	89.23	89.98	90.79	91.36	91.96	

Average = Sum(39)$_{1…12}$ /12= 91.07 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.77	0.77	0.77	0.76	0.75	0.74	0.74	0.74	0.75	0.75	0.76	0.76	

Average = Sum(40)$_{1…12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.86 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 102.24 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	112.46	108.37	104.28	100.19	96.1	92.02	92.02	96.1	100.19	104.28	108.37	112.46	

Total = Sum(44)$_{1…12}$ = 1226.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.78	145.87	150.52	131.23	125.92	108.66	100.69	115.54	116.92	136.26	148.74	161.52	

Total = Sum(45)$_{1…12}$ = 1608.62 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.02	21.88	22.58	19.68	18.89	16.3	15.1	17.33	17.54	20.44	22.31	24.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	213.37	187.95	197.12	176.32	172.51	153.75	147.28	162.13	162.01	182.85	193.83	208.11	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	213.37	187.95	197.12	176.32	172.51	153.75	147.28	162.13	162.01	182.85	193.83	208.11

Output from water heater (annual)$_{1...12}$ | 2157.24 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.73	82.17	87.32	79.71	79.14	72.2	70.75	75.69	74.95	82.58	85.53	90.98	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	27.11	24.08	19.58	14.83	11.08	9.36	10.11	13.14	17.64	22.4	26.14	27.87	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	285.72	288.68	281.21	265.31	245.23	226.36	213.75	210.79	218.26	234.16	254.24	273.11	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	(71)

Water heating gains (Table 5)

(72)m=	124.64	122.28	117.37	110.7	106.38	100.28	95.1	101.74	104.1	111	118.79	122.29	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	506.44	504.01	487.14	459.81	431.66	404.97	387.93	394.64	408.97	436.53	468.14	492.24	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.06	x	10.63	x	0.63	x	0.7	=	16.44	(74)
North	0.9x	0.77	x	3.68	x	10.63	x	0.63	x	0.7	=	11.96	(74)

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North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.63	x	0.7	=	31.42	(74)
North	0.9x	0.77	x	3.68	x	20.32	x	0.63	x	0.7	=	22.85	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.63	x	0.7	=	53.4	(74)
North	0.9x	0.77	x	3.68	x	34.53	x	0.63	x	0.7	=	38.83	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.63	x	0.7	=	85.77	(74)
North	0.9x	0.77	x	3.68	x	55.46	x	0.63	x	0.7	=	62.38	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.63	x	0.7	=	115.54	(74)
North	0.9x	0.77	x	3.68	x	74.72	x	0.63	x	0.7	=	84.03	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.63	x	0.7	=	123.69	(74)
North	0.9x	0.77	x	3.68	x	79.99	x	0.63	x	0.7	=	89.96	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.63	x	0.7	=	115.48	(74)
North	0.9x	0.77	x	3.68	x	74.68	x	0.63	x	0.7	=	83.99	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.63	x	0.7	=	91.62	(74)
North	0.9x	0.77	x	3.68	x	59.25	x	0.63	x	0.7	=	66.63	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.63	x	0.7	=	64.2	(74)
North	0.9x	0.77	x	3.68	x	41.52	x	0.63	x	0.7	=	46.69	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.63	x	0.7	=	37.41	(74)
North	0.9x	0.77	x	3.68	x	24.19	x	0.63	x	0.7	=	27.2	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	5.06	x	13.12	x	0.63	x	0.7	=	20.29	(74)
North	0.9x	0.77	x	3.68	x	13.12	x	0.63	x	0.7	=	14.75	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)

North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.63	x	0.7	=	13.71	(74)
North	0.9x	0.77	x	3.68	x	8.86	x	0.63	x	0.7	=	9.97	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
South	0.9x	0.77	x	3.22	x	46.75	x	0.63	x	0.7	=	46.01	(78)
South	0.9x	0.77	x	3.22	x	76.57	x	0.63	x	0.7	=	75.35	(78)
South	0.9x	0.77	x	3.22	x	97.53	x	0.63	x	0.7	=	95.98	(78)
South	0.9x	0.77	x	3.22	x	110.23	x	0.63	x	0.7	=	108.48	(78)
South	0.9x	0.77	x	3.22	x	114.87	x	0.63	x	0.7	=	113.04	(78)
South	0.9x	0.77	x	3.22	x	110.55	x	0.63	x	0.7	=	108.79	(78)
South	0.9x	0.77	x	3.22	x	108.01	x	0.63	x	0.7	=	106.29	(78)
South	0.9x	0.77	x	3.22	x	104.89	x	0.63	x	0.7	=	103.22	(78)
South	0.9x	0.77	x	3.22	x	101.89	x	0.63	x	0.7	=	100.26	(78)
South	0.9x	0.77	x	3.22	x	82.59	x	0.63	x	0.7	=	81.27	(78)
South	0.9x	0.77	x	3.22	x	55.42	x	0.63	x	0.7	=	54.53	(78)
South	0.9x	0.77	x	3.22	x	40.4	x	0.63	x	0.7	=	39.75	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	92.35	163.91	246.46	350.2	438.66	457.37	431.74	361.42	281.19	186.69	111.7	78.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	598.79	667.92	733.61	810.01	870.32	862.33	819.67	756.06	690.16	623.22	579.85	570.62	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.86	0.65	0.48	0.54	0.83	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.2	20.31	20.49	20.73	20.92	20.99	21	21	20.96	20.72	20.42	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.28	20.28	20.28	20.29	20.29	20.3	20.3	20.3	20.3	20.29	20.29	20.28	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.96	0.82	0.59	0.4	0.46	0.77	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.18	19.34	19.61	19.97	20.22	20.3	20.3	20.3	20.26	19.96	19.52	19.17	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.63	19.87	20.2	20.43	20.51	20.51	20.51	20.47	20.19	19.79	19.47	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.63	19.87	20.2	20.43	20.51	20.51	20.51	20.47	20.19	19.79	19.47	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.95	0.83	0.61	0.43	0.48	0.78	0.97	1	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	597.94	665.66	725.9	773.37	724.38	522.34	349.56	365.92	540.67	605.76	577.72	570.04	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1415.93	1368.61	1237.88	1028.9	792.4	528.38	349.98	366.93	573.42	870.31	1159.25	1404.42	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	608.59	472.38	380.91	183.98	50.61	0	0	0	0	196.83	418.7	620.78

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2932.79 (98)

Space heating requirement in kWh/m²/year 24.36 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	608.59	472.38	380.91	183.98	50.61	0	0	0	0	196.83	418.7	620.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	650.9	505.22	407.39	196.77	54.13	0	0	0	0	210.51	447.81	663.94	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3136.67 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	213.37	187.95	197.12	176.32	172.51	153.75	147.28	162.13	162.01	182.85	193.83	208.11	
Efficiency of water heater												79.8	(216)
(217)m=	87.46	87.17	86.54	84.93	82	79.8	79.8	79.8	79.8	85.01	86.82	87.55	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	243.98	215.61	227.77	207.61	210.38	192.67	184.56	203.17	203.02	215.09	223.26	237.7

Total = Sum(219a)$_{1...12}$ = 2564.83 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3136.67
Water heating fuel used		2564.83
Electricity for pumps, fans and electric keep-hot		

central heating pump:		30	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		478.82	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	677.52	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	554	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1231.52	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	248.51	(268)
Total CO2, kg/year			sum of (265)…(271) =		1518.96	(272)

TER = 12.62 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**

Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-4-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	120.39	(1a) x	2.4	(2a) =	288.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	120.39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	288.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			3.68	x1/[1/(1.2)+ 0.04]		=	4.21			(27)
Windows Type 2			5.06	x1/[1/(1.2)+ 0.04]		=	5.79			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			3.22	x1/[1/(1.2)+ 0.04]		=	3.69			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	32.79	17.48	15.31	x	0.18	=	2.76			(29)
Walls Type2	25.04	2.1	22.94	x	0.18	=	4.13			(29)
Roof	34.94	0	34.94	x	0.11	=	3.84			(30)
Total area of elements, m²			92.77							(31)
Party wall			61.8	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.26 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.75 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 49.01 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	96.68	96.68	96.68	96.68	96.68	96.68	96.68	96.68	96.68	96.68	96.68	96.68	

Average = Sum(39)$_{1…12}$ /12= 96.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	

Average = Sum(40)$_{1…12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.86 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 102.24 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	112.46	108.37	104.28	100.19	96.1	92.02	92.02	96.1	100.19	104.28	108.37	112.46	

Total = Sum(44)$_{1…12}$ = 1226.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.78	145.87	150.52	131.23	125.92	108.66	100.69	115.54	116.92	136.26	148.74	161.52	

Total = Sum(45)$_{1…12}$ = 1608.62 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.02	21.88	22.58	19.68	18.89	16.3	15.1	17.33	17.54	20.44	22.31	24.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	222.06	195.79	205.8	184.72	181.19	162.15	155.96	170.82	170.41	191.53	202.23	216.79	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	222.06	195.79	205.8	184.72	181.19	162.15	155.96	170.82	170.41	191.53	202.23	216.79

Output from water heater (annual)$_{1...12}$ | 2259.46 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	99.68	88.44	94.27	86.43	86.09	78.92	77.7	82.64	81.67	89.53	92.25	97.93	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	26.39	23.44	19.06	14.43	10.79	9.11	9.84	12.79	17.17	21.8	25.44	27.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	285.72	288.68	281.21	265.31	245.23	226.36	213.75	210.79	218.26	234.16	254.24	273.11	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	(71)

Water heating gains (Table 5)

(72)m=	133.97	131.61	126.71	120.04	115.71	109.62	104.43	111.07	113.43	120.33	128.12	131.62	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	512.05	509.71	492.95	465.75	437.7	411.05	394	400.62	414.83	442.27	473.78	497.83	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	3.68	x	10.63	x	0.5	x	0.8	=	10.85	(74)
North	0.9x	0.77	x	5.06	x	10.63	x	0.5	x	0.8	=	14.91	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	3.68	x	20.32	x	0.5	x	0.8	=	20.73	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.5	x	0.8	=	28.5	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	3.68	x	34.53	x	0.5	x	0.8	=	35.22	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.5	x	0.8	=	48.43	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	3.68	x	55.46	x	0.5	x	0.8	=	56.58	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.5	x	0.8	=	77.8	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	3.68	x	74.72	x	0.5	x	0.8	=	76.22	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.5	x	0.8	=	104.8	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	3.68	x	79.99	x	0.5	x	0.8	=	81.59	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.5	x	0.8	=	112.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	3.68	x	74.68	x	0.5	x	0.8	=	76.18	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.5	x	0.8	=	104.74	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	3.68	x	59.25	x	0.5	x	0.8	=	60.44	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.5	x	0.8	=	83.1	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	3.68	x	41.52	x	0.5	x	0.8	=	42.35	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.5	x	0.8	=	58.23	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	3.68	x	24.19	x	0.5	x	0.8	=	24.68	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.5	x	0.8	=	33.93	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	3.68	x	13.12	x	0.5	x	0.8	=	13.38	(74)

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North	0.9x	0.77	x	5.06	x	13.12	x	0.5	x	0.8	=	18.4	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	3.68	x	8.86	x	0.5	x	0.8	=	9.04	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.5	x	0.8	=	12.43	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
South	0.9x	0.77	x	3.22	x	46.75	x	0.5	x	0.8	=	41.73	(78)
South	0.9x	0.77	x	3.22	x	76.57	x	0.5	x	0.8	=	68.34	(78)
South	0.9x	0.77	x	3.22	x	97.53	x	0.5	x	0.8	=	87.06	(78)
South	0.9x	0.77	x	3.22	x	110.23	x	0.5	x	0.8	=	98.39	(78)
South	0.9x	0.77	x	3.22	x	114.87	x	0.5	x	0.8	=	102.53	(78)
South	0.9x	0.77	x	3.22	x	110.55	x	0.5	x	0.8	=	98.67	(78)
South	0.9x	0.77	x	3.22	x	108.01	x	0.5	x	0.8	=	96.41	(78)
South	0.9x	0.77	x	3.22	x	104.89	x	0.5	x	0.8	=	93.63	(78)
South	0.9x	0.77	x	3.22	x	101.89	x	0.5	x	0.8	=	90.94	(78)
South	0.9x	0.77	x	3.22	x	82.59	x	0.5	x	0.8	=	73.71	(78)
South	0.9x	0.77	x	3.22	x	55.42	x	0.5	x	0.8	=	49.46	(78)
South	0.9x	0.77	x	3.22	x	40.4	x	0.5	x	0.8	=	36.06	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	83.76	148.67	223.55	317.64	397.87	414.85	391.6	327.82	255.05	169.33	101.32	71.1	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	595.82	658.38	716.5	783.39	835.57	825.9	785.6	728.44	669.88	611.6	575.1	568.93	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.9	0.72	0.54	0.6	0.87	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.25	20.43	20.66	20.88	20.98	21	20.99	20.93	20.66	20.36	20.12	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.97	0.87	0.65	0.45	0.51	0.81	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.1	19.24	19.5	19.84	20.13	20.24	20.25	20.25	20.19	19.84	19.4	19.05	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.41	19.54	19.78	20.09	20.35	20.46	20.47	20.47	20.41	20.09	19.69	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.41	19.54	19.78	20.09	20.35	20.46	20.47	20.47	20.41	20.09	19.69	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.97	0.87	0.67	0.48	0.54	0.83	0.98	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	595	656.39	710.3	756.83	728.34	551.82	373.24	390.88	554.14	597.89	573.19	568.35	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1461.12	1415.89	1283.54	1081.43	836.43	566.5	374.55	393.72	610.28	917.51	1216.99	1466.91	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	644.4	510.38	426.49	233.71	80.42	0	0	0	0	237.79	463.54	668.53	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3265.26 (98)

Space heating requirement in kWh/m²/year 27.12 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		3265.26	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	3428.52	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2259.46	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2372.43	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	58.01	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		77.9	(330a)

warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	77.9	(331)
Energy for lighting (calculated in Appendix L)		466.03	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1347.32	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	30.11	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1377.43	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1377.43	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	40.43	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	241.87	(379)
Total CO2, kg/year	sum of (376)…(382) =				1659.73	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				13.79	(384)
EI rating (section 14)					86.55	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-4-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	120.39	(1a) x	2.4	(2a) =	288.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	120.39	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		288.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.14	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.31	0.33	0.35	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			3.68	x1/[1/(1.4)+ 0.04]		=	4.88			(27)
Windows Type 2			5.06	x1/[1/(1.4)+ 0.04]		=	6.71			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			3.22	x1/[1/(1.4)+ 0.04]		=	4.27			(27)
Windows Type 5			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	32.79	17.48	15.31	x	0.18	=	2.76			(29)
Walls Type2	25.04	2.1	22.94	x	0.18	=	4.13			(29)
Roof	34.94	0	34.94	x	0.13	=	4.54			(30)
Total area of elements, m²			92.77							(31)
Party wall			61.8	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 36.7 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.72 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 45.42 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	56.12	55.8	55.47	53.96	53.68	52.36	52.36	52.12	52.87	53.68	54.25	54.85	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	101.54	101.22	100.89	99.38	99.1	97.79	97.79	97.54	98.29	99.1	99.67	100.27	

Average = Sum(39)$_{1\ldots12}$ /12= 99.38 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.84	0.84	0.84	0.83	0.82	0.81	0.81	0.81	0.82	0.82	0.83	0.83	

Average = Sum(40)$_{1\ldots12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.86 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 102.24 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	112.46	108.37	104.28	100.19	96.1	92.02	92.02	96.1	100.19	104.28	108.37	112.46	

Total = Sum(44)$_{1\ldots12}$ = 1226.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.78	145.87	150.52	131.23	125.92	108.66	100.69	115.54	116.92	136.26	148.74	161.52	

Total = Sum(45)$_{1\ldots12}$ = 1608.62 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.02	21.88	22.58	19.68	18.89	16.3	15.1	17.33	17.54	20.44	22.31	24.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	213.37	187.95	197.12	176.32	172.51	153.75	147.28	162.13	162.01	182.85	193.83	208.11	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	213.37	187.95	197.12	176.32	172.51	153.75	147.28	162.13	162.01	182.85	193.83	208.11

Output from water heater (annual)$_{1...12}$ | 2157.24 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.73	82.17	87.32	79.71	79.14	72.2	70.75	75.69	74.95	82.58	85.53	90.98	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	27.11	24.08	19.58	14.83	11.08	9.36	10.11	13.14	17.64	22.4	26.14	27.87	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	285.72	288.68	281.21	265.31	245.23	226.36	213.75	210.79	218.26	234.16	254.24	273.11	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	(71)

Water heating gains (Table 5)

(72)m=	124.64	122.28	117.37	110.7	106.38	100.28	95.1	101.74	104.1	111	118.79	122.29	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	506.44	504.01	487.14	459.81	431.66	404.97	387.93	394.64	408.97	436.53	468.14	492.24	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	3.68	x	10.63	x	0.63	x	0.7	=	11.96	(74)
North	0.9x	0.77	x	5.06	x	10.63	x	0.63	x	0.7	=	16.44	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	3.68	x	20.32	x	0.63	x	0.7	=	22.85	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.63	x	0.7	=	31.42	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	3.68	x	34.53	x	0.63	x	0.7	=	38.83	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.63	x	0.7	=	53.4	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	3.68	x	55.46	x	0.63	x	0.7	=	62.38	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.63	x	0.7	=	85.77	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	3.68	x	74.72	x	0.63	x	0.7	=	84.03	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.63	x	0.7	=	115.54	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	3.68	x	79.99	x	0.63	x	0.7	=	89.96	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.63	x	0.7	=	123.69	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	3.68	x	74.68	x	0.63	x	0.7	=	83.99	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.63	x	0.7	=	115.48	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	3.68	x	59.25	x	0.63	x	0.7	=	66.63	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.63	x	0.7	=	91.62	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	3.68	x	41.52	x	0.63	x	0.7	=	46.69	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.63	x	0.7	=	64.2	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	3.68	x	24.19	x	0.63	x	0.7	=	27.2	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.63	x	0.7	=	37.41	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	3.68	x	13.12	x	0.63	x	0.7	=	14.75	(74)

North	0.9x	0.77	x	5.06	x	13.12	x	0.63	x	0.7	=	20.29	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	3.68	x	8.86	x	0.63	x	0.7	=	9.97	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.63	x	0.7	=	13.71	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
South	0.9x	0.77	x	3.22	x	46.75	x	0.63	x	0.7	=	46.01	(78)
South	0.9x	0.77	x	3.22	x	76.57	x	0.63	x	0.7	=	75.35	(78)
South	0.9x	0.77	x	3.22	x	97.53	x	0.63	x	0.7	=	95.98	(78)
South	0.9x	0.77	x	3.22	x	110.23	x	0.63	x	0.7	=	108.48	(78)
South	0.9x	0.77	x	3.22	x	114.87	x	0.63	x	0.7	=	113.04	(78)
South	0.9x	0.77	x	3.22	x	110.55	x	0.63	x	0.7	=	108.79	(78)
South	0.9x	0.77	x	3.22	x	108.01	x	0.63	x	0.7	=	106.29	(78)
South	0.9x	0.77	x	3.22	x	104.89	x	0.63	x	0.7	=	103.22	(78)
South	0.9x	0.77	x	3.22	x	101.89	x	0.63	x	0.7	=	100.26	(78)
South	0.9x	0.77	x	3.22	x	82.59	x	0.63	x	0.7	=	81.27	(78)
South	0.9x	0.77	x	3.22	x	55.42	x	0.63	x	0.7	=	54.53	(78)
South	0.9x	0.77	x	3.22	x	40.4	x	0.63	x	0.7	=	39.75	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	92.35	163.91	246.46	350.2	438.66	457.37	431.74	361.42	281.19	186.69	111.7	78.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	598.79	667.92	733.61	810.01	870.32	862.33	819.67	756.06	690.16	623.22	579.85	570.62	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.89	0.7	0.52	0.59	0.86	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.2	20.39	20.66	20.88	20.98	21	21	20.93	20.65	20.33	20.08	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.22	20.22	20.22	20.23	20.23	20.24	20.24	20.24	20.24	20.23	20.23	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.97	0.86	0.63	0.43	0.49	0.8	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.98	19.15	19.43	19.81	20.11	20.23	20.24	20.24	20.18	19.81	19.34	18.97	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.32	19.46	19.72	20.07	20.34	20.46	20.47	20.47	20.41	20.07	19.64	19.3	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.32	19.46	19.72	20.07	20.34	20.46	20.47	20.47	20.41	20.07	19.64	19.3	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	1	1	0.99	0.96	0.86	0.65	0.46	0.52	0.82	0.98	1	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	597.95	665.8	726.84	779.95	749.98	559.67	377.15	394.33	564.89	608.64	577.87	570.03		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	1524.86	1474.17	1333.41	1109.78	856.4	572.6	378.29	396.83	619.8	938.14	1249.84	1514.17		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	689.63	543.23	451.29	237.48	79.18	0	0	0	0	245.15	483.82	702.44		
Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =													3432.2	(98)
Space heating requirement in kWh/m²/year													28.51	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	689.63	543.23	451.29	237.48	79.18	0	0	0	0	245.15	483.82	702.44		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	737.57	580.99	482.66	253.99	84.68	0	0	0	0	262.19	517.45	751.27		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3670.8	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	213.37	187.95	197.12	176.32	172.51	153.75	147.28	162.13	162.01	182.85	193.83	208.11		
Efficiency of water heater													79.8	(216)
(217)m=	87.72	87.48	86.96	85.61	82.88	79.8	79.8	79.8	79.8	85.6	87.16	87.81		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	243.24	214.84	226.69	205.96	208.14	192.67	184.56	203.17	203.02	213.62	222.39	237.01		
Total = Sum(219a)$_{1...12}$ =													2555.31	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3670.8

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Water heating fuel used			2555.31	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			478.82	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	792.89	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	551.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1344.84	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	248.51	(268)
Total CO2, kg/year		sum of (265)…(271) =		1632.27	(272)

TER = 13.56 (273)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version: Version: 1.0.4.8

Property Address: a1-5-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	85.47	(1a) x	2.4	(2a) =	205.13	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	85.47	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.13	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)
(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)
(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			5.06	x1/[1/(1.2)+ 0.04]		=	5.79			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 6			0.01	x1/[1/(1.2)+ 0.04]		=	0.01			(27)
Windows Type 7			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	50.79	18.87	31.92	x	0.18	=	5.75			(29)
Walls Type2	25.04	2.1	22.94	x	0.18	=	4.13			(29)
Total area of elements, m²			75.83							(31)
Party wall			25.74	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	34	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	11.23	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

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Total fabric heat loss	(33) + (36) =	45.23	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	79.08	79.08	79.08	79.08	79.08	79.08	79.08	79.08	79.08	79.08	79.08	79.08	

Average = $Sum(39)_{1\ldots12}$ /12= 79.08 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	

Average = $Sum(40)_{1\ldots12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.56 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 94.96 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	104.46	100.66	96.86	93.07	89.27	85.47	85.47	89.27	93.07	96.86	100.66	104.46	

Total = $Sum(44)_{1\ldots12}$ = 1139.57 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	154.91	135.49	139.81	121.89	116.96	100.92	93.52	107.32	108.6	126.56	138.15	150.02	

Total = $Sum(45)_{1\ldots12}$ = 1494.16 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.24	20.32	20.97	18.28	17.54	15.14	14.03	16.1	16.29	18.98	20.72	22.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.19	185.41	195.09	175.38	172.23	154.42	148.8	162.59	162.09	181.84	191.65	205.3	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	210.19	185.41	195.09	175.38	172.23	154.42	148.8	162.59	162.09	181.84	191.65	205.3

Output from water heater (annual)1…12 | 2145 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	95.73	84.99	90.71	83.32	83.11	76.35	75.32	79.9	78.9	86.3	88.73	94.1	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.55	18.25	14.84	11.24	8.4	7.09	7.66	9.96	13.37	16.97	19.81	21.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	230.49	232.88	226.86	214.03	197.83	182.61	172.44	170.04	176.07	188.9	205.1	220.32	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	(71)

Water heating gains (Table 5)

(72)m=	128.67	126.48	121.92	115.73	111.71	106.05	101.23	107.4	109.59	116	123.24	126.48	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	441.09	438.99	425	402.37	379.31	357.12	342.71	348.78	360.41	383.25	409.53	429.3	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.06	x	10.63	x	0.5	x	0.8	=	14.91	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.5	x	0.8	=	28.5	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.5	x	0.8	=	48.43	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.5	x	0.8	=	77.8	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.5	x	0.8	=	104.8	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.5	x	0.8	=	112.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.5	x	0.8	=	104.74	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.5	x	0.8	=	83.1	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.5	x	0.8	=	58.23	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.5	x	0.8	=	33.93	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.06	x	13.12	x	0.5	x	0.8	=	18.4	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.5	x	0.8	=	12.43	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
South	0.9x	0.77	x	0.01	x	46.75	x	0.5	x	0.8	=	0.13	(78)
South	0.9x	0.77	x	0.01	x	76.57	x	0.5	x	0.8	=	0.21	(78)
South	0.9x	0.77	x	0.01	x	97.53	x	0.5	x	0.8	=	0.27	(78)

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South	0.9x	0.77	x	0.01	x	110.23	x	0.5	x	0.8	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	114.87	x	0.5	x	0.8	=	0.32	(78)
South	0.9x	0.77	x	0.01	x	110.55	x	0.5	x	0.8	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	108.01	x	0.5	x	0.8	=	0.3	(78)
South	0.9x	0.77	x	0.01	x	104.89	x	0.5	x	0.8	=	0.29	(78)
South	0.9x	0.77	x	0.01	x	101.89	x	0.5	x	0.8	=	0.28	(78)
South	0.9x	0.77	x	0.01	x	82.59	x	0.5	x	0.8	=	0.23	(78)
South	0.9x	0.77	x	0.01	x	55.42	x	0.5	x	0.8	=	0.15	(78)
South	0.9x	0.77	x	0.01	x	40.4	x	0.5	x	0.8	=	0.11	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)

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West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	76.39	147.99	246.77	374.77	479.02	500.6	472.28	391.35	290.94	175.81	94.83	63.18	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	517.48	586.98	671.76	777.14	858.33	857.72	814.99	740.13	651.35	559.06	504.36	492.48	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.78	0.58	0.43	0.49	0.77	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.08	20.21	20.44	20.73	20.93	20.99	21	21	20.95	20.68	20.32	20.04	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.91	0.73	0.51	0.34	0.4	0.7	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.1	19.44	19.84	20.08	20.14	20.15	20.14	20.11	19.77	19.26	18.85	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.38	19.54	19.84	20.2	20.42	20.48	20.49	20.49	20.45	20.13	19.68	19.33	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.38	19.54	19.84	20.2	20.42	20.48	20.49	20.49	20.45	20.13	19.68	19.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.91	0.75	0.54	0.38	0.43	0.73	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	515.52	582.04	654.8	706.84	643.06	459.49	306.82	321.84	473.11	531.69	500.11	491.08	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1192.27	1158.1	1054.85	893.23	689.48	464.96	307.37	323.1	501.78	753.92	994.77	1196.41	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	503.5	387.11	297.64	134.2	34.53	0	0	0	0	165.34	356.15	524.77	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2403.24 (98)

Space heating requirement in kWh/m²/year 28.12 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2403.24	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2523.4	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2145	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2252.25	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	47.76	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		55.31	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	55.31	(331)
Energy for lighting (calculated in Appendix L)		362.89	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1109.18	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	24.79	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1133.97	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1133.97	(376)

CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	28.7	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	188.34	(379)
Total CO2, kg/year	sum of (376)…(382) =			1351.02	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.81	(384)
EI rating (section 14)				86.12	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-5-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	85.47	(1a) x	2.4	(2a) =	205.13	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	85.47	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.13	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			5.06	x1/[1/(1.4)+ 0.04]		=	6.71			(27)
Windows Type 5			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 6			0.01	x1/[1/(1.4)+ 0.04]		=	0.01			(27)
Windows Type 7			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	50.79	18.87	31.92	x	0.18	=	5.75			(29)
Walls Type2	25.04	2.1	22.94	x	0.18	=	4.13			(29)
Total area of elements, m²			75.83							(31)
Party wall			25.74	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	36.99	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	4.93	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

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Total fabric heat loss	(33) + (36) =	41.92	(37)
Ventilation heat loss calculated monthly	(38)m = 0.33 × (25)m x (5)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.09	39.85	39.61	38.49	38.28	37.31	37.31	37.13	37.69	38.28	38.71	39.15	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	82.01	81.76	81.53	80.41	80.2	79.23	79.23	79.05	79.6	80.2	80.62	81.07	

Average = Sum(39)$_{1…12}$ /12= 80.41 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.96	0.96	0.95	0.94	0.94	0.93	0.93	0.92	0.93	0.94	0.94	0.95	

Average = Sum(40)$_{1…12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.56 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 94.96 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	104.46	100.66	96.86	93.07	89.27	85.47	85.47	89.27	93.07	96.86	100.66	104.46	

Total = Sum(44)$_{1…12}$ = 1139.57 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	154.91	135.49	139.81	121.89	116.96	100.92	93.52	107.32	108.6	126.56	138.15	150.02	

Total = Sum(45)$_{1…12}$ = 1494.16 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.24	20.32	20.97	18.28	17.54	15.14	14.03	16.1	16.29	18.98	20.72	22.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		150	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)			
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)			
Water storage loss:			
a) If manufacturer’s declared loss factor is known (kWh/day):		1.39	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0.75	(50)
b) If manufacturer’s declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.75	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.51	177.57	186.41	166.98	163.55	146.02	140.12	153.91	153.69	173.16	183.24	196.62	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.51	177.57	186.41	166.98	163.55	146.02	140.12	153.91	153.69	173.16	183.24	196.62	

Output from water heater (annual)$_{1...12}$ | 2042.78 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	88.78	78.72	83.76	76.6	76.16	69.63	68.37	72.96	72.18	79.36	82.01	87.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.55	18.26	14.85	11.24	8.4	7.09	7.66	9.96	13.37	16.98	19.82	21.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	230.49	232.88	226.86	214.03	197.83	182.61	172.44	170.04	176.07	188.9	205.1	220.32	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	(71)

Water heating gains (Table 5)

(72)m=	119.33	117.14	112.58	106.39	102.37	96.71	91.9	98.06	100.25	106.66	113.9	117.15	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	434.76	432.66	418.67	396.04	372.98	350.79	336.38	342.45	354.07	376.92	403.19	422.97	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.06	x	10.63	x	0.63	x	0.7	=	16.44	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.63	x	0.7	=	31.42	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.63	x	0.7	=	53.4	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.63	x	0.7	=	85.77	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.63	x	0.7	=	115.54	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.63	x	0.7	=	123.69	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.63	x	0.7	=	115.48	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.63	x	0.7	=	91.62	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.63	x	0.7	=	64.2	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.63	x	0.7	=	37.41	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	5.06	x	13.12	x	0.63	x	0.7	=	20.29	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.63	x	0.7	=	13.71	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
South	0.9x	0.77	x	0.01	x	46.75	x	0.63	x	0.7	=	0.14	(78)
South	0.9x	0.77	x	0.01	x	76.57	x	0.63	x	0.7	=	0.23	(78)
South	0.9x	0.77	x	0.01	x	97.53	x	0.63	x	0.7	=	0.3	(78)

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South	0.9x	0.77	x	0.01	x	110.23	x	0.63	x	0.7	=	0.34	(78)
South	0.9x	0.77	x	0.01	x	114.87	x	0.63	x	0.7	=	0.35	(78)
South	0.9x	0.77	x	0.01	x	110.55	x	0.63	x	0.7	=	0.34	(78)
South	0.9x	0.77	x	0.01	x	108.01	x	0.63	x	0.7	=	0.33	(78)
South	0.9x	0.77	x	0.01	x	104.89	x	0.63	x	0.7	=	0.32	(78)
South	0.9x	0.77	x	0.01	x	101.89	x	0.63	x	0.7	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	82.59	x	0.63	x	0.7	=	0.25	(78)
South	0.9x	0.77	x	0.01	x	55.42	x	0.63	x	0.7	=	0.17	(78)
South	0.9x	0.77	x	0.01	x	40.4	x	0.63	x	0.7	=	0.12	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)

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West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	84.22	163.16	272.06	413.19	528.11	551.92	520.69	431.46	320.77	193.83	104.55	69.66	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	518.98	595.82	690.72	809.22	901.09	902.7	857.07	773.91	674.84	570.75	507.75	492.63	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.76	0.55	0.41	0.47	0.76	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.03	20.18	20.43	20.74	20.93	20.99	21	21	20.96	20.68	20.3	20.01	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.12	20.12	20.13	20.14	20.14	20.14	20.15	20.14	20.14	20.13	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.9	0.71	0.48	0.33	0.38	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.82	19.03	19.39	19.84	20.08	20.14	20.14	20.15	20.11	19.76	19.22	18.79	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.3	19.49	19.81	20.2	20.42	20.48	20.49	20.49	20.45	20.13	19.65	19.28	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.3	19.49	19.81	20.2	20.42	20.48	20.49	20.49	20.45	20.13	19.65	19.28	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.9	0.73	0.51	0.36	0.42	0.71	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	517.01	590.6	672.01	728.36	657.25	461.59	307.47	322.03	479.2	541.27	503.41	491.22	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1230.32	1192.83	1084.81	908.55	699.28	465.91	307.9	323.03	505.2	764.08	1011.76	1222.27	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	530.7	404.7	307.12	129.73	31.27	0	0	0	0	165.77	366.02	543.9	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2479.22 (98)

Space heating requirement in kWh/m²/year 29.01 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	530.7	404.7	307.12	129.73	31.27	0	0	0	0	165.77	366.02	543.9		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	567.6	432.84	328.47	138.75	33.45	0	0	0	0	177.29	391.46	581.71		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2651.57	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	201.51	177.57	186.41	166.98	163.55	146.02	140.12	153.91	153.69	173.16	183.24	196.62		
Efficiency of water heater													79.8	(216)
(217)m=	87.28	86.94	86.14	84.15	81.34	79.8	79.8	79.8	79.8	84.7	86.62	87.39		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	230.88	204.24	216.4	198.43	201.06	182.98	175.58	192.87	192.6	204.44	211.54	224.99		
Total = Sum(219a)$_{1...12}$ =													2436.02	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2651.57	
Water heating fuel used			2436.02	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			362.98	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	572.74	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	526.18	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1098.92	(265)

Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	188.39	(268)
Total CO2, kg/year			sum of (265)…(271) =		1326.23	(272)

TER =	15.52	(273)

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User Details:

Assessor Name: | **Stroma Number:**

Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-8-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.94	(1a) x	2.4	(2a) =	179.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.94	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	179.86	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			5.98	x1/[1/(1.2)+ 0.04]		=	6.85			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	41.4	14.26	27.14	x	0.18	=	4.89			(29)
Walls Type2	10.58	2.1	8.48	x	0.18	=	1.53			(29)
Total area of elements, m²			51.98							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.26 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 13.45 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 38.71 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	68.38	68.38	68.38	68.38	68.38	68.38	68.38	68.38	68.38	68.38	68.38	68.38	

Average = $Sum(39)_{1…12}$ /12= 68.38 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91

Average = Sum(40)$_{1…12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.36 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	99.27	95.66	92.05	88.44	84.83	81.22	81.22	84.83	88.44	92.05	95.66	99.27	

Total = Sum(44)$_{1…12}$ = 1082.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.22	128.76	132.87	115.83	111.15	95.91	88.88	101.99	103.2	120.27	131.29	142.57

Total = Sum(45)$_{1…12}$ = 1419.93 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.08	19.31	19.93	17.38	16.67	14.39	13.33	15.3	15.48	18.04	19.69	21.39	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.49	178.68	188.14	169.33	166.42	149.4	144.15	157.26	156.7	175.55	184.78	197.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.49	178.68	188.14	169.33	166.42	149.4	144.15	157.26	156.7	175.55	184.78	197.85	

Output from water heater (annual)$_{1...12}$ 2070.77 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.17	82.75	88.4	81.31	81.18	74.69	73.77	78.13	77.11	84.21	86.45	91.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.61	16.53	13.44	10.17	7.61	6.42	6.94	9.02	12.1	15.37	17.94	19.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	208.54	210.71	205.25	193.64	178.99	165.22	156.01	153.85	159.3	170.91	185.57	199.34	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	(71)

Water heating gains (Table 5)

(72)m=	125.23	123.15	118.82	112.93	109.11	103.73	99.16	105.02	107.1	113.19	120.07	123.15	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	410.78	408.77	395.91	375.15	354.1	333.76	320.51	326.28	336.9	357.87	381.97	400.02	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	5.98	x	10.63	x	0.5	x	0.8	=	17.63	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.98	x	20.32	x	0.5	x	0.8	=	33.69	(74)

North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.98	x	34.53	x	0.5	x	0.8	=	57.24	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.98	x	55.46	x	0.5	x	0.8	=	91.94	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.98	x	74.72	x	0.5	x	0.8	=	123.85	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.98	x	79.99	x	0.5	x	0.8	=	132.59	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.98	x	74.68	x	0.5	x	0.8	=	123.79	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.98	x	59.25	x	0.5	x	0.8	=	98.21	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.98	x	41.52	x	0.5	x	0.8	=	68.82	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.98	x	24.19	x	0.5	x	0.8	=	40.1	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.98	x	13.12	x	0.5	x	0.8	=	21.74	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	5.98	x	8.86	x	0.5	x	0.8	=	14.69	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)

East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	48.92	94.17	158.48	247.41	324.7	343.55	322.38	261.3	188.65	111.99	60.55	40.62	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	459.7	502.95	554.39	622.56	678.8	677.31	642.89	587.58	525.55	469.86	442.52	440.63	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.83	0.63	0.47	0.53	0.81	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.1	20.21	20.42	20.69	20.9	20.99	21	21	20.94	20.67	20.33	20.07	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.16	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.78	0.55	0.38	0.44	0.74	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.96	19.11	19.41	19.79	20.07	20.15	20.16	20.16	20.11	19.77	19.29	18.91	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.42	19.55	19.81	20.15	20.4	20.48	20.49	20.49	20.44	20.13	19.7	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.42	19.55	19.81	20.15	20.4	20.48	20.49	20.49	20.44	20.13	19.7	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.8	0.58	0.41	0.47	0.76	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	457.83	499.11	543.4	580.29	540.58	395.18	265.47	278.15	401.85	449.88	438.74	439.23	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1033.65	1002.09	910.41	769.47	595	402.26	266.21	279.78	433.58	651.46	861.96	1037.56	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	428.41	338	273.05	136.21	40.49	0	0	0	0	149.97	304.72	445.16	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2116.02 (98)

Space heating requirement in kWh/m²/year 28.24 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2116.02	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2221.82	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2070.77	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2174.31	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.96	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		48.49	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	48.49	(331)
Energy for lighting (calculated in Appendix L)		328.59	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1021.04	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	22.82	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1043.85	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1043.85	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	25.17	(378)

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CO2 associated with electricity for lighting	(332))) x	0.52	=	170.54	(379)
Total CO2, kg/year	sum of (376)…(382) =			1239.56	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.54	(384)
EI rating (section 14)				86.15	(385)

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User Details:

Assessor Name: | **Stroma Number:**

Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-8-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.94	(1a) x	2.4	(2a) =	179.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.94	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	179.86	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			5.98	x1/[1/(1.4)+ 0.04]		=	7.93			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	41.4	14.26	27.14	x	0.18	=	4.89			(29)
Walls Type2	10.58	2.1	8.48	x	0.18	=	1.53			(29)
Total area of elements, m²			51.98							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 27.42 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.01 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 41.42 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.73	35.5	35.27	34.18	33.98	33.04	33.04	32.86	33.4	33.98	34.39	34.82	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	77.15	76.92	76.69	75.61	75.4	74.46	74.46	74.29	74.82	75.4	75.81	76.24	

Average = Sum(39)$_{1\ldots12}$ /12= 75.6 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.03	1.03	1.02	1.01	1.01	0.99	0.99	0.99	1	1.01	1.01	1.02

Average = Sum(40)$_{1…12}$ /12= 1.01 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.36 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	99.27	95.66	92.05	88.44	84.83	81.22	81.22	84.83	88.44	92.05	95.66	99.27

Total = Sum(44)$_{1…12}$ = 1082.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.22	128.76	132.87	115.83	111.15	95.91	88.88	101.99	103.2	120.27	131.29	142.57

Total = Sum(45)$_{1…12}$ = 1419.93 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.08	19.31	19.93	17.38	16.67	14.39	13.33	15.3	15.48	18.04	19.69	21.39	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	193.81	170.84	179.46	160.93	157.74	141	135.47	148.58	148.3	166.87	176.38	189.17	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	193.81	170.84	179.46	160.93	157.74	141	135.47	148.58	148.3	166.87	176.38	189.17

Output from water heater (annual)$_{1...12}$ 1968.55 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.23	76.48	81.45	74.59	74.23	67.96	66.83	71.19	70.39	77.27	79.73	84.68	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	18.83	16.73	13.6	10.3	7.7	6.5	7.02	9.13	12.25	15.56	18.16	19.36	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	208.54	210.71	205.25	193.64	178.99	165.22	156.01	153.85	159.3	170.91	185.57	199.34	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	(71)
Water heating gains (Table 5)													
(72)m=	115.89	113.81	109.48	103.6	99.77	94.39	89.82	95.68	97.76	103.85	110.73	113.82	(72)
Total internal gains =						(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m							
(73)m=	404.67	402.64	389.74	368.94	347.86	327.51	314.26	320.06	330.72	351.72	375.86	393.91	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	5.98	x	10.63	x	0.63	x	0.7	=	19.43	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	5.98	x	20.32	x	0.63	x	0.7	=	37.14	(74)

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North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	5.98	x	34.53	x	0.63	x	0.7	=	63.11	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	5.98	x	55.46	x	0.63	x	0.7	=	101.36	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	5.98	x	74.72	x	0.63	x	0.7	=	136.55	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	5.98	x	79.99	x	0.63	x	0.7	=	146.18	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	5.98	x	74.68	x	0.63	x	0.7	=	136.48	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	5.98	x	59.25	x	0.63	x	0.7	=	108.28	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	5.98	x	41.52	x	0.63	x	0.7	=	75.87	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	5.98	x	24.19	x	0.63	x	0.7	=	44.21	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	5.98	x	13.12	x	0.63	x	0.7	=	23.97	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
North	0.9x	0.77	x	5.98	x	8.86	x	0.63	x	0.7	=	16.2	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)

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East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	53.94	103.83	174.73	272.77	357.98	378.76	355.42	288.08	207.98	123.47	66.76	44.78	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	458.61	506.47	564.46	641.71	705.84	706.27	669.68	608.14	538.7	475.19	442.61	438.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.85	0.65	0.48	0.55	0.83	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.94	20.06	20.29	20.61	20.87	20.98	21	20.99	20.91	20.59	20.21	19.92	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.06	20.06	20.06	20.08	20.08	20.09	20.09	20.09	20.08	20.08	20.07	20.07	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.8	0.57	0.39	0.45	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.64	18.82	19.15	19.62	19.95	20.07	20.09	20.09	20.01	19.59	19.05	18.62	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.16	19.31	19.61	20.02	20.32	20.43	20.45	20.45	20.37	19.99	19.51	19.14	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.16	19.31	19.61	20.02	20.32	20.43	20.45	20.45	20.37	19.99	19.51	19.14	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.81	0.6	0.43	0.49	0.79	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	456.81	502.78	554.01	601.27	572.58	423.34	285.38	297.99	422.98	457.16	439.1	437.34	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1146.14	1108.69	1005.2	840.39	649.64	434.47	286.74	300.82	469.34	708.14	941.18	1138.81	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	512.86	407.17	335.68	172.17	57.33	0	0	0	0	186.72	361.5	521.89	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = | 2555.33 | (98)

Space heating requirement in kWh/m²/year | 34.1 | (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system | 0 | (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	512.86	407.17	335.68	172.17	57.33	0	0	0	0	186.72	361.5	521.89		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	548.51	435.48	359.02	184.14	61.32	0	0	0	0	199.71	386.63	558.17		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2732.98	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	193.81	170.84	179.46	160.93	157.74	141	135.47	148.58	148.3	166.87	176.38	189.17		
Efficiency of water heater													79.8	(216)
(217)m=	87.29	87.05	86.46	84.99	82.4	79.8	79.8	79.8	79.8	85.11	86.69	87.38		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	222.03	196.26	207.56	189.34	191.44	176.7	169.76	186.19	185.83	196.05	203.47	216.48		
Total = Sum(219a)$_{1...12}$ =													2341.11	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2732.98	
Water heating fuel used			2341.11	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			332.62	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	590.32	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	505.68	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1096	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	172.63	(268)

TER WorkSheet: New dwelling design stage

Total CO2, kg/year	sum of (265)…(271) =	1307.56	(272)
TER =		17.45	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version: Version: 1.0.4.8

Property Address: a1-8-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	85.47	(1a) x	2.4	(2a) =	205.13	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	85.47	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.13	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			5.06	x1/[1/(1.2)+ 0.04]		=	5.79			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 6			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 7			0.01	x1/[1/(1.2)+ 0.04]		=	0.01			(27)
Walls Type1	50.79	18.87	31.92	x	0.18	=	5.75			(29)
Walls Type2	25.04	2.1	22.94	x	0.18	=	4.13			(29)
Total area of elements, m²			75.83							(31)
Party wall			25.74	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 13.07 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss	(33) + (36) =	47.08	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	80.92	80.92	80.92	80.92	80.92	80.92	80.92	80.92	80.92	80.92	80.92	80.92	

Average = Sum(39)$_{1…12}$ /12= 80.92 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	

Average = Sum(40)$_{1…12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.56 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 94.96 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	104.46	100.66	96.86	93.07	89.27	85.47	85.47	89.27	93.07	96.86	100.66	104.46	

Total = Sum(44)$_{1…12}$ = 1139.57 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	154.91	135.49	139.81	121.89	116.96	100.92	93.52	107.32	108.6	126.56	138.15	150.02	

Total = Sum(45)$_{1…12}$ = 1494.16 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.24	20.32	20.97	18.28	17.54	15.14	14.03	16.1	16.29	18.98	20.72	22.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		0	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)			
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)			
Water storage loss:			
a) If manufacturer’s declared loss factor is known (kWh/day):		0	(48)
Temperature factor from Table 2b		0	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	110	(50)
b) If manufacturer’s declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0.02	(51)
If community heating see section 4.3			
Volume factor from Table 2a		1.03	(52)
Temperature factor from Table 2b		0.6	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	1.03	(54)
Enter (50) or (54) in (55)		1.03	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.19	185.41	195.09	175.38	172.23	154.42	148.8	162.59	162.09	181.84	191.65	205.3	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	210.19	185.41	195.09	175.38	172.23	154.42	148.8	162.59	162.09	181.84	191.65	205.3

Output from water heater (annual)$_{1\ldots12}$ | 2145 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	95.73	84.99	90.71	83.32	83.11	76.35	75.32	79.9	78.9	86.3	88.73	94.1	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.55	18.25	14.84	11.24	8.4	7.09	7.66	9.96	13.37	16.97	19.81	21.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	230.49	232.88	226.86	214.03	197.83	182.61	172.44	170.04	176.07	188.9	205.1	220.32	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	(71)

Water heating gains (Table 5)

(72)m=	128.67	126.48	121.92	115.73	111.71	106.05	101.23	107.4	109.59	116	123.24	126.48	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	441.09	438.99	425	402.37	379.31	357.12	342.71	348.78	360.41	383.25	409.53	429.3	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	5.06	x	10.63	x	0.5	x	0.8	=	14.91	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.5	x	0.8	=	28.5	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.5	x	0.8	=	48.43	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.5	x	0.8	=	77.8	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.5	x	0.8	=	104.8	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.5	x	0.8	=	112.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.5	x	0.8	=	104.74	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.5	x	0.8	=	83.1	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.5	x	0.8	=	58.23	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.5	x	0.8	=	33.93	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.06	x	13.12	x	0.5	x	0.8	=	18.4	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.5	x	0.8	=	12.43	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
South	0.9x	0.77	x	0.01	x	46.75	x	0.5	x	0.8	=	0.13	(78)
South	0.9x	0.77	x	0.01	x	76.57	x	0.5	x	0.8	=	0.21	(78)
South	0.9x	0.77	x	0.01	x	97.53	x	0.5	x	0.8	=	0.27	(78)

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South	0.9x	0.77	x	0.01	x	110.23	x	0.5	x	0.8	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	114.87	x	0.5	x	0.8	=	0.32	(78)
South	0.9x	0.77	x	0.01	x	110.55	x	0.5	x	0.8	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	108.01	x	0.5	x	0.8	=	0.3	(78)
South	0.9x	0.77	x	0.01	x	104.89	x	0.5	x	0.8	=	0.29	(78)
South	0.9x	0.77	x	0.01	x	101.89	x	0.5	x	0.8	=	0.28	(78)
South	0.9x	0.77	x	0.01	x	82.59	x	0.5	x	0.8	=	0.23	(78)
South	0.9x	0.77	x	0.01	x	55.42	x	0.5	x	0.8	=	0.15	(78)
South	0.9x	0.77	x	0.01	x	40.4	x	0.5	x	0.8	=	0.11	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)

West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	76.39	147.99	246.77	374.77	479.02	500.6	472.28	391.35	290.94	175.81	94.83	63.18	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	517.48	586.98	671.76	777.14	858.33	857.72	814.99	740.13	651.35	559.06	504.36	492.48	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.79	0.59	0.44	0.5	0.78	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.05	20.18	20.42	20.71	20.92	20.99	21	21	20.94	20.66	20.29	20.01	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.91	0.74	0.52	0.35	0.41	0.71	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.85	19.04	19.38	19.79	20.05	20.12	20.13	20.13	20.08	19.73	19.2	18.8	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.33	19.5	19.8	20.16	20.4	20.47	20.48	20.47	20.43	20.1	19.64	19.28	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.33	19.5	19.8	20.16	20.4	20.47	20.48	20.47	20.43	20.1	19.64	19.28	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.91	0.76	0.55	0.38	0.44	0.74	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	515.54	582.14	655.38	709.91	651.04	468.16	312.93	328.14	479.3	532.78	500.19	491.08	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1216.15	1181.27	1075.93	911.27	703.89	474.78	313.63	329.71	512.11	768.84	1014.56	1220.38	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	521.26	402.62	312.89	144.98	39.32	0	0	0	0	175.63	370.35	542.6	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 2509.63 (98)

Space heating requirement in kWh/m²/year 29.36 (99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2509.63	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2635.11	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2145	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2252.25	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	48.87	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		55.31	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	55.31	(331)
Energy for lighting (calculated in Appendix L)		362.89	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1135.13	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	25.37	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1160.5	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1160.5	(376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	28.7	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	188.34	(379)
Total CO2, kg/year	sum of (376)…(382) =			1377.54	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.12	(384)
EI rating (section 14)				85.85	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-8-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	85.47	(1a) x	2.4	(2a) =	205.13	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	85.47	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.13	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			5.06	x1/[1/(1.4)+ 0.04]		=	6.71			(27)
Windows Type 5			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 6			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 7			0.01	x1/[1/(1.4)+ 0.04]		=	0.01			(27)
Walls Type1	50.79	18.87	31.92	x	0.18	=	5.75			(29)
Walls Type2	25.04	2.1	22.94	x	0.18	=	4.13			(29)
Total area of elements, m²			75.83							(31)
Party wall			25.74	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	36.99	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	12.38	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

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Total fabric heat loss	(33) + (36) =	49.37	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.09	39.85	39.61	38.49	38.28	37.31	37.31	37.13	37.69	38.28	38.71	39.15	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	89.46	89.22	88.98	87.86	87.65	86.68	86.68	86.5	87.06	87.65	88.08	88.52	

Average = Sum(39)$_{1…12}$ /12= 87.86 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.05	1.04	1.04	1.03	1.03	1.01	1.01	1.01	1.02	1.03	1.03	1.04	

Average = Sum(40)$_{1…12}$ /12= 1.03 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.56 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 94.96 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	104.46	100.66	96.86	93.07	89.27	85.47	85.47	89.27	93.07	96.86	100.66	104.46	

Total = Sum(44)$_{1…12}$ = 1139.57 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	154.91	135.49	139.81	121.89	116.96	100.92	93.52	107.32	108.6	126.56	138.15	150.02	

Total = Sum(45)$_{1…12}$ = 1494.16 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.24	20.32	20.97	18.28	17.54	15.14	14.03	16.1	16.29	18.98	20.72	22.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		150	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)			
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)			
Water storage loss:			
a) If manufacturer’s declared loss factor is known (kWh/day):		1.39	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0.75	(50)
b) If manufacturer’s declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.75	(55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.51	177.57	186.41	166.98	163.55	146.02	140.12	153.91	153.69	173.16	183.24	196.62	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.51	177.57	186.41	166.98	163.55	146.02	140.12	153.91	153.69	173.16	183.24	196.62

Output from water heater (annual)$_{1...12}$ | 2042.78 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	88.78	78.72	83.76	76.6	76.16	69.63	68.37	72.96	72.18	79.36	82.01	87.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.55	18.26	14.85	11.24	8.4	7.09	7.66	9.96	13.37	16.98	19.82	21.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	230.49	232.88	226.86	214.03	197.83	182.61	172.44	170.04	176.07	188.9	205.1	220.32	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	(71)

Water heating gains (Table 5)

(72)m=	119.33	117.14	112.58	106.39	102.37	96.71	91.9	98.06	100.25	106.66	113.9	117.15	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	434.76	432.66	418.67	396.04	372.98	350.79	336.38	342.45	354.07	376.92	403.19	422.97	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	5.06	x	10.63	x	0.63	x	0.7	=	16.44	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.63	x	0.7	=	31.42	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.63	x	0.7	=	53.4	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.63	x	0.7	=	85.77	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.63	x	0.7	=	115.54	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.63	x	0.7	=	123.69	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.63	x	0.7	=	115.48	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.63	x	0.7	=	91.62	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.63	x	0.7	=	64.2	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.63	x	0.7	=	37.41	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	5.06	x	13.12	x	0.63	x	0.7	=	20.29	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.63	x	0.7	=	13.71	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
South	0.9x	0.77	x	0.01	x	46.75	x	0.63	x	0.7	=	0.14	(78)
South	0.9x	0.77	x	0.01	x	76.57	x	0.63	x	0.7	=	0.23	(78)
South	0.9x	0.77	x	0.01	x	97.53	x	0.63	x	0.7	=	0.3	(78)

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South	0.9x	0.77	x	0.01	x	110.23	x	0.63	x	0.7	=	0.34	(78)
South	0.9x	0.77	x	0.01	x	114.87	x	0.63	x	0.7	=	0.35	(78)
South	0.9x	0.77	x	0.01	x	110.55	x	0.63	x	0.7	=	0.34	(78)
South	0.9x	0.77	x	0.01	x	108.01	x	0.63	x	0.7	=	0.33	(78)
South	0.9x	0.77	x	0.01	x	104.89	x	0.63	x	0.7	=	0.32	(78)
South	0.9x	0.77	x	0.01	x	101.89	x	0.63	x	0.7	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	82.59	x	0.63	x	0.7	=	0.25	(78)
South	0.9x	0.77	x	0.01	x	55.42	x	0.63	x	0.7	=	0.17	(78)
South	0.9x	0.77	x	0.01	x	40.4	x	0.63	x	0.7	=	0.12	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)

West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	84.22	163.16	272.06	413.19	528.11	551.92	520.69	431.46	320.77	193.83	104.55	69.66	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	518.98	595.82	690.72	809.22	901.09	902.7	857.07	773.91	674.84	570.75	507.75	492.63	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.94	0.8	0.6	0.44	0.51	0.79	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.91	20.05	20.32	20.66	20.9	20.98	21	20.99	20.93	20.6	20.19	19.88	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.04	20.05	20.05	20.06	20.06	20.07	20.07	20.07	20.07	20.06	20.06	20.05	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.91	0.75	0.52	0.35	0.41	0.72	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.58	18.8	19.18	19.66	19.96	20.06	20.07	20.07	20.01	19.6	19.01	18.56	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.11	19.3	19.63	20.06	20.34	20.43	20.44	20.44	20.38	20	19.48	19.09	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.11	19.3	19.63	20.06	20.34	20.43	20.44	20.44	20.38	20	19.48	19.09	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.91	0.76	0.55	0.39	0.45	0.75	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	517.02	590.88	674.06	740.35	688.78	496.33	331.91	347.22	503.4	545.22	503.65	491.21	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1325.11	1284.91	1168.66	980.66	757.04	505.35	332.97	349.51	546.51	823.61	1090.65	1317.7	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	601.22	466.39	367.98	173.02	50.79	0	0	0	0	207.13	422.64	614.91	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 2904.08 (98)

Space heating requirement in kWh/m²/year 33.98 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	601.22	466.39	367.98	173.02	50.79	0	0	0	0	207.13	422.64	614.91		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	643.02	498.81	393.56	185.05	54.32	0	0	0	0	221.53	452.03	657.66		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3105.97	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	201.51	177.57	186.41	166.98	163.55	146.02	140.12	153.91	153.69	173.16	183.24	196.62		
Efficiency of water heater													79.8	(216)
(217)m=	87.55	87.27	86.6	84.91	82.1	79.8	79.8	79.8	79.8	85.29	86.97	87.65		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	230.15	203.47	215.26	196.66	199.21	182.98	175.58	192.87	192.6	203.02	210.69	224.32		
Total = Sum(219a)$_{1...12}$ =													2426.81	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3105.97	
Water heating fuel used			2426.81	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			362.98	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	670.89	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	524.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1195.08	(265)

TER WorkSheet: New dwelling design stage

Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	188.39	(268)
Total CO2, kg/year		sum of (265)…(271) =		1422.39	(272)

TER = 16.64 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-9-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	89.66	(1a) x	2.4	(2a) =	215.18	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	89.66	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.18	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			10.01	x1/[1/(1.2)+ 0.04]		=	11.46			(27)
Windows Type 3			4.22	x1/[1/(1.2)+ 0.04]		=	4.83			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	48.26	22.51	25.75	x	0.18	=	4.63			(29)
Walls Type2	18.56	2.1	16.46	x	0.18	=	2.96			(29)
Roof	89.66	0	89.66	x	0.11	=	9.86			(30)
Total area of elements, m²			156.48							(31)
Party wall			29.7	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	45.76	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		17.26	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	63.01	(37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.51	35.51	35.51	35.51	35.51	35.51	35.51	35.51	35.51	35.51	35.51	35.51	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	98.52	98.52	98.52	98.52	98.52	98.52	98.52	98.52	98.52	98.52	98.52	98.52	

Average = Sum(39)$_{1…12}$ /12= 98.52 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	

Average = Sum(40)$_{1…12}$ /12= 1.1 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.62 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.45 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	106.09	102.24	98.38	94.52	90.66	86.8	86.8	90.66	94.52	98.38	102.24	106.09	
									Total = Sum(44)$_{1…12}$ =			1157.4	(44)
	Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)												
(45)m=	157.34	137.61	142	123.8	118.79	102.5	94.98	109	110.3	128.54	140.31	152.37	
									Total = Sum(45)$_{1…12}$ =			1517.53	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.6	20.64	21.3	18.57	17.82	15.38	14.25	16.35	16.54	19.28	21.05	22.86	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	212.61	187.53	197.27	177.29	174.06	156	150.26	164.27	163.79	183.82	193.81	207.65	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	212.61	187.53	197.27	177.29	174.06	156	150.26	164.27	163.79	183.82	193.81	207.65

Output from water heater (annual)$_{1...12}$ | 2168.37 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	96.54	85.7	91.44	83.96	83.72	76.88	75.8	80.46	79.47	86.96	89.45	94.88	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.26	18.88	15.36	11.62	8.69	7.34	7.93	10.3	13.83	17.56	20.5	21.85	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	238.45	240.93	234.69	221.42	204.66	188.91	178.39	175.92	182.15	195.42	212.18	227.93	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	(71)

Water heating gains (Table 5)

(72)m=	129.75	127.52	122.9	116.61	112.52	106.77	101.89	108.15	110.37	116.88	124.23	127.53	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	451.78	449.65	435.26	411.96	388.19	365.34	350.52	356.68	368.67	392.18	419.23	439.63	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	10.01	x	10.63	x	0.5	x	0.8	=	29.51	(74)
North	0.9x	0.77	x	10.01	x	20.32	x	0.5	x	0.8	=	56.39	(74)
North	0.9x	0.77	x	10.01	x	34.53	x	0.5	x	0.8	=	95.81	(74)
North	0.9x	0.77	x	10.01	x	55.46	x	0.5	x	0.8	=	153.9	(74)
North	0.9x	0.77	x	10.01	x	74.72	x	0.5	x	0.8	=	207.32	(74)
North	0.9x	0.77	x	10.01	x	79.99	x	0.5	x	0.8	=	221.94	(74)
North	0.9x	0.77	x	10.01	x	74.68	x	0.5	x	0.8	=	207.21	(74)
North	0.9x	0.77	x	10.01	x	59.25	x	0.5	x	0.8	=	164.4	(74)
North	0.9x	0.77	x	10.01	x	41.52	x	0.5	x	0.8	=	115.2	(74)
North	0.9x	0.77	x	10.01	x	24.19	x	0.5	x	0.8	=	67.12	(74)
North	0.9x	0.77	x	10.01	x	13.12	x	0.5	x	0.8	=	36.4	(74)
North	0.9x	0.77	x	10.01	x	8.86	x	0.5	x	0.8	=	24.6	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	4.22	x	19.64	x	0.5	x	0.8	=	22.97	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	4.22	x	38.42	x	0.5	x	0.8	=	44.94	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	4.22	x	63.27	x	0.5	x	0.8	=	74.02	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	4.22	x	92.28	x	0.5	x	0.8	=	107.95	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	4.22	x	113.09	x	0.5	x	0.8	=	132.29	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	4.22	x	115.77	x	0.5	x	0.8	=	135.43	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	4.22	x	110.22	x	0.5	x	0.8	=	128.93	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)

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East	0.9x	1	x	4.22	x	94.68	x	0.5	x	0.8	=	110.75	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	4.22	x	73.59	x	0.5	x	0.8	=	86.08	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	4.22	x	45.59	x	0.5	x	0.8	=	53.33	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	4.22	x	24.49	x	0.5	x	0.8	=	28.65	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	4.22	x	16.15	x	0.5	x	0.8	=	18.89	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	97.56	189.51	315.06	473.65	599.19	623.09	589.12	492.45	370.19	225.09	121.25	80.56	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	549.34	639.16	750.31	885.62	987.37	988.42	939.64	849.13	738.86	617.27	540.48	520.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.81	0.61	0.46	0.52	0.8	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.84	20	20.27	20.62	20.87	20.98	21	20.99	20.91	20.55	20.12	19.8	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20	20	20	20	20	20	20	20	20	20	20	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.91	0.75	0.53	0.36	0.42	0.72	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.45	18.68	19.08	19.56	19.88	19.99	20	20	19.93	19.48	18.86	18.39	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.01	19.21	19.55	19.98	20.28	20.38	20.4	20.4	20.32	19.91	19.37	18.96	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.01	19.21	19.55	19.98	20.28	20.38	20.4	20.4	20.32	19.91	19.37	18.96	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.91	0.77	0.56	0.4	0.46	0.75	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	547.16	633.46	730.8	808.43	757.85	555.53	372.35	389.77	555.52	589.26	535.95	518.61	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1449.07	1409.44	1286.08	1091.83	845.22	569.63	374.21	393.64	612.94	917.1	1208.54	1453.78	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	671.02	521.46	413.14	204.05	65	0	0	0	0	243.91	484.27	695.77	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	3298.61	(98)
Space heating requirement in kWh/m²/year	36.79	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		3298.61	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	3463.55	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2168.37	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2276.79	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	57.4	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		58.02	(330a)

warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =		58.02	(331)
Energy for lighting (calculated in Appendix L)			375.42	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1333.24	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	29.79	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1363.03	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1363.03	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	30.11	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	194.85	(379)
Total CO2, kg/year	sum of (376)…(382) =				1587.99	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17.71	(384)
EI rating (section 14)					84.2	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: a1-9-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	89.66	(1a) x	2.4	(2a) =	215.18	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	89.66	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.18	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.39	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.41	0.41	0.36	0.36	0.31	0.31	0.31	0.33	0.36	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.49	x1/[1/(1.4)+ 0.04]		=	3.3			(27)
Windows Type 2			9.03	x1/[1/(1.4)+ 0.04]		=	11.97			(27)
Windows Type 3			3.81	x1/[1/(1.4)+ 0.04]		=	5.05			(27)
Windows Type 4			2.49	x1/[1/(1.4)+ 0.04]		=	3.3			(27)
Windows Type 5			2.49	x1/[1/(1.4)+ 0.04]		=	3.3			(27)
Walls Type1	48.26	20.31	27.95	x	0.18	=	5.03			(29)
Walls Type2	18.56	2.1	16.46	x	0.18	=	2.96			(29)
Roof	89.66	0	89.66	x	0.13	=	11.66			(30)
Total area of elements, m²			156.48							(31)
Party wall			29.7	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 48.68 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 18.33 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 67 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	41.83	41.58	41.34	40.21	40	39.02	39.02	38.83	39.4	40	40.43	40.88		(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	108.83	108.59	108.34	107.21	107	106.02	106.02	105.84	106.4	107	107.43	107.88		
									Average = Sum(39)$_{1…12}$ /12=				107.21	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.21	1.21	1.21	1.2	1.19	1.18	1.18	1.18	1.19	1.19	1.2	1.2		
									Average = Sum(40)$_{1…12}$ /12=				1.2	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.62 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.45 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)														
(44)m=	106.09	102.24	98.38	94.52	90.66	86.8	86.8	90.66	94.52	98.38	102.24	106.09		
									Total = Sum(44)$_{1…12}$ =				1157.4	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)														
(45)m=	157.34	137.61	142	123.8	118.79	102.5	94.98	109	110.3	128.54	140.31	152.37		
									Total = Sum(45)$_{1…12}$ =				1517.53	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)														
(46)m=	23.6	20.64	21.3	18.57	17.82	15.38	14.25	16.35	16.54	19.28	21.05	22.86		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	203.93	179.69	188.59	168.89	165.38	147.6	141.58	155.59	155.39	175.14	185.4	198.97	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	203.93	179.69	188.59	168.89	165.38	147.6	141.58	155.59	155.39	175.14	185.4	198.97

Output from water heater (annual)$_{1...12}$ — 2066.15 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.59	79.42	84.49	77.24	76.77	70.16	68.86	73.52	72.75	80.02	82.73	87.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.25	18.88	15.35	11.62	8.69	7.33	7.93	10.3	13.83	17.56	20.49	21.84	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	238.45	240.93	234.69	221.42	204.66	188.91	178.39	175.92	182.15	195.42	212.18	227.93	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	(71)

Water heating gains (Table 5)

(72)m=	120.42	118.19	113.56	107.27	103.19	97.44	92.55	98.81	101.04	107.55	114.9	118.2	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	445.44	443.31	428.92	405.63	381.85	359	344.18	350.35	362.33	385.85	412.89	433.29	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	9.03	x	10.63	x	0.63	x	0.7	=	29.34	(74)
North	0.9x	0.77	x	9.03	x	20.32	x	0.63	x	0.7	=	56.08	(74)
North	0.9x	0.77	x	9.03	x	34.53	x	0.63	x	0.7	=	95.29	(74)
North	0.9x	0.77	x	9.03	x	55.46	x	0.63	x	0.7	=	153.06	(74)
North	0.9x	0.77	x	9.03	x	74.72	x	0.63	x	0.7	=	206.19	(74)
North	0.9x	0.77	x	9.03	x	79.99	x	0.63	x	0.7	=	220.73	(74)
North	0.9x	0.77	x	9.03	x	74.68	x	0.63	x	0.7	=	206.08	(74)
North	0.9x	0.77	x	9.03	x	59.25	x	0.63	x	0.7	=	163.5	(74)
North	0.9x	0.77	x	9.03	x	41.52	x	0.63	x	0.7	=	114.57	(74)
North	0.9x	0.77	x	9.03	x	24.19	x	0.63	x	0.7	=	66.76	(74)
North	0.9x	0.77	x	9.03	x	13.12	x	0.63	x	0.7	=	36.2	(74)
North	0.9x	0.77	x	9.03	x	8.86	x	0.63	x	0.7	=	24.46	(74)
East	0.9x	1	x	2.49	x	19.64	x	0.63	x	0.7	=	14.95	(76)
East	0.9x	1	x	3.81	x	19.64	x	0.63	x	0.7	=	22.87	(76)
East	0.9x	1	x	2.49	x	19.64	x	0.63	x	0.7	=	14.95	(76)
East	0.9x	1	x	2.49	x	19.64	x	0.63	x	0.7	=	14.95	(76)
East	0.9x	1	x	2.49	x	38.42	x	0.63	x	0.7	=	29.24	(76)
East	0.9x	1	x	3.81	x	38.42	x	0.63	x	0.7	=	44.74	(76)
East	0.9x	1	x	2.49	x	38.42	x	0.63	x	0.7	=	29.24	(76)
East	0.9x	1	x	2.49	x	38.42	x	0.63	x	0.7	=	29.24	(76)
East	0.9x	1	x	2.49	x	63.27	x	0.63	x	0.7	=	48.15	(76)
East	0.9x	1	x	3.81	x	63.27	x	0.63	x	0.7	=	73.67	(76)
East	0.9x	1	x	2.49	x	63.27	x	0.63	x	0.7	=	48.15	(76)
East	0.9x	1	x	2.49	x	63.27	x	0.63	x	0.7	=	48.15	(76)
East	0.9x	1	x	2.49	x	92.28	x	0.63	x	0.7	=	70.22	(76)
East	0.9x	1	x	3.81	x	92.28	x	0.63	x	0.7	=	107.45	(76)
East	0.9x	1	x	2.49	x	92.28	x	0.63	x	0.7	=	70.22	(76)
East	0.9x	1	x	2.49	x	92.28	x	0.63	x	0.7	=	70.22	(76)
East	0.9x	1	x	2.49	x	113.09	x	0.63	x	0.7	=	86.06	(76)
East	0.9x	1	x	3.81	x	113.09	x	0.63	x	0.7	=	131.68	(76)
East	0.9x	1	x	2.49	x	113.09	x	0.63	x	0.7	=	86.06	(76)
East	0.9x	1	x	2.49	x	113.09	x	0.63	x	0.7	=	86.06	(76)
East	0.9x	1	x	2.49	x	115.77	x	0.63	x	0.7	=	88.1	(76)
East	0.9x	1	x	3.81	x	115.77	x	0.63	x	0.7	=	134.8	(76)
East	0.9x	1	x	2.49	x	115.77	x	0.63	x	0.7	=	88.1	(76)
East	0.9x	1	x	2.49	x	115.77	x	0.63	x	0.7	=	88.1	(76)
East	0.9x	1	x	2.49	x	110.22	x	0.63	x	0.7	=	83.87	(76)
East	0.9x	1	x	3.81	x	110.22	x	0.63	x	0.7	=	128.34	(76)
East	0.9x	1	x	2.49	x	110.22	x	0.63	x	0.7	=	83.87	(76)
East	0.9x	1	x	2.49	x	110.22	x	0.63	x	0.7	=	83.87	(76)
East	0.9x	1	x	2.49	x	94.68	x	0.63	x	0.7	=	72.05	(76)

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East	0.9x	1	x	3.81	x	94.68	x	0.63	x	0.7	=	110.24	(76)
East	0.9x	1	x	2.49	x	94.68	x	0.63	x	0.7	=	72.05	(76)
East	0.9x	1	x	2.49	x	94.68	x	0.63	x	0.7	=	72.05	(76)
East	0.9x	1	x	2.49	x	73.59	x	0.63	x	0.7	=	56	(76)
East	0.9x	1	x	3.81	x	73.59	x	0.63	x	0.7	=	85.69	(76)
East	0.9x	1	x	2.49	x	73.59	x	0.63	x	0.7	=	56	(76)
East	0.9x	1	x	2.49	x	73.59	x	0.63	x	0.7	=	56	(76)
East	0.9x	1	x	2.49	x	45.59	x	0.63	x	0.7	=	34.69	(76)
East	0.9x	1	x	3.81	x	45.59	x	0.63	x	0.7	=	53.08	(76)
East	0.9x	1	x	2.49	x	45.59	x	0.63	x	0.7	=	34.69	(76)
East	0.9x	1	x	2.49	x	45.59	x	0.63	x	0.7	=	34.69	(76)
East	0.9x	1	x	2.49	x	24.49	x	0.63	x	0.7	=	18.64	(76)
East	0.9x	1	x	3.81	x	24.49	x	0.63	x	0.7	=	28.51	(76)
East	0.9x	1	x	2.49	x	24.49	x	0.63	x	0.7	=	18.64	(76)
East	0.9x	1	x	2.49	x	24.49	x	0.63	x	0.7	=	18.64	(76)
East	0.9x	1	x	2.49	x	16.15	x	0.63	x	0.7	=	12.29	(76)
East	0.9x	1	x	3.81	x	16.15	x	0.63	x	0.7	=	18.81	(76)
East	0.9x	1	x	2.49	x	16.15	x	0.63	x	0.7	=	12.29	(76)
East	0.9x	1	x	2.49	x	16.15	x	0.63	x	0.7	=	12.29	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	97.05	188.53	313.42	471.18	596.06	619.83	586.04	489.88	368.26	223.92	120.62	80.14	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	542.49	631.83	742.33	876.81	977.91	978.83	930.22	840.22	730.59	609.76	533.51	513.43	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.84	0.65	0.49	0.56	0.83	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.68	19.84	20.13	20.51	20.82	20.96	20.99	20.98	20.87	20.46	20	19.65	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.91	19.91	19.91	19.92	19.93	19.93	19.93	19.94	19.93	19.93	19.92	19.92	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.78	0.56	0.38	0.44	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.15	18.39	18.81	19.36	19.75	19.91	19.93	19.93	19.83	19.3	18.63	18.12	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.76	18.97	19.34	19.82	20.18	20.33	20.36	20.35	20.24	19.76	19.18	18.73	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.76	18.97	19.34	19.82	20.18	20.33	20.36	20.35	20.24	19.76	19.18	18.73	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.92	0.8	0.6	0.42	0.49	0.78	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	540.38	626.56	725.24	810.97	779.68	583.89	394.6	411.35	570.8	585.58	529.32	511.89	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1574.05	1527.84	1391.07	1171.09	907.12	607.36	398.13	418.23	653.7	980.63	1297.78	1567.72	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	769.05	605.66	495.38	259.29	94.82	0	0	0	0	293.92	553.29	785.54	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3856.94 (98)

Space heating requirement in kWh/m²/year 43.02 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	769.05	605.66	495.38	259.29	94.82	0	0	0	0	293.92	553.29	785.54		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	822.52	647.76	529.82	277.31	101.41	0	0	0	0	314.35	591.75	840.15		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													4125.07	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	203.93	179.69	188.59	168.89	165.38	147.6	141.58	155.59	155.39	175.14	185.4	198.97		
Efficiency of water heater													79.8	(216)
(217)m=	88.03	87.81	87.27	85.95	83.39	79.8	79.8	79.8	79.8	86.19	87.55	88.11		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	231.67	204.65	216.09	196.49	198.32	184.96	177.42	194.98	194.72	203.21	211.76	225.81		
Total = Sum(219a)$_{1...12}$ =													2440.07	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		4125.07

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Water heating fuel used			2440.07	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			375.35	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	891.01	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	527.05	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1418.07	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	194.81	(268)
Total CO2, kg/year		sum of (265)…(271) =		1651.8	(272)
TER =				18.42	(273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-9-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.39	(1a) x	2.4	(2a) =	171.34	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.34	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.06	x1/[1/(1.2)+ 0.04]		=	5.79			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	40.85	13.34	27.51	x	0.18	=	4.95			(29)
Walls Type2	12.13	2.1	10.03	x	0.18	=	1.81			(29)
Roof	71.39	0	71.39	x	0.11	=	7.85			(30)
Total area of elements, m²			124.37							(31)
Party wall			28.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	32.4	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		13.99	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	46.39	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	28.27	28.27	28.27	28.27	28.27	28.27	28.27	28.27	28.27	28.27	28.27	28.27	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	74.66	74.66	74.66	74.66	74.66	74.66	74.66	74.66	74.66	74.66	74.66	74.66	

Average = Sum(39)$_{1…12}$ /12= 74.66 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	

Average = Sum(40)$_{1…12}$ /12= 1.05 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.28 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.17	93.64	90.1	86.57	83.04	79.5	79.5	83.04	86.57	90.1	93.64	97.17	

Total = Sum(44)$_{1…12}$ = 1060.03 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.1	126.03	130.05	113.38	108.79	93.88	86.99	99.83	101.02	117.73	128.51	139.55	

Total = Sum(45)$_{1…12}$ = 1389.86 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.61	18.9	19.51	17.01	16.32	14.08	13.05	14.97	15.15	17.66	19.28	20.93	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.38	175.96	185.33	166.88	164.07	147.37	142.27	155.1	154.51	173	182	194.83	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.38	175.96	185.33	166.88	164.07	147.37	142.27	155.1	154.51	173	182	194.83	

Output from water heater (annual)$_{1...12}$	2040.7	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.13	81.85	87.46	80.49	80.4	74.01	73.15	77.41	76.38	83.37	85.52	90.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	17.91	15.9	12.93	9.79	7.32	6.18	6.68	8.68	11.65	14.79	17.26	18.4	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	200.52	202.6	197.36	186.19	172.1	158.86	150.01	147.93	153.17	164.34	178.43	191.67	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	(71)
Water heating gains (Table 5)													
(72)m=	123.84	121.8	117.56	111.8	108.06	102.79	98.32	104.05	106.09	112.05	118.78	121.8	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	399.45	397.49	385.04	364.97	344.67	325.02	312.2	317.85	328.1	348.37	371.67	389.07	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.06	x	19.64	x	0.5	x	0.8	=	27.55	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)

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East	0.9x	1	x	5.06	x	38.42	x	0.5	x	0.8	=	53.89	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	5.06	x	63.27	x	0.5	x	0.8	=	88.75	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	5.06	x	92.28	x	0.5	x	0.8	=	129.44	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	5.06	x	113.09	x	0.5	x	0.8	=	158.63	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	5.06	x	115.77	x	0.5	x	0.8	=	162.38	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	5.06	x	110.22	x	0.5	x	0.8	=	154.6	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	5.06	x	94.68	x	0.5	x	0.8	=	132.8	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	5.06	x	73.59	x	0.5	x	0.8	=	103.22	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	5.06	x	45.59	x	0.5	x	0.8	=	63.94	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	5.06	x	24.49	x	0.5	x	0.8	=	34.35	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	5.06	x	16.15	x	0.5	x	0.8	=	22.65	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)

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South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	114.11	200.44	286.4	368.71	420.92	420.11	404.19	365.73	315.42	225.19	137.88	96.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	513.56	597.94	671.44	733.69	765.59	745.13	716.39	683.59	643.52	573.56	509.55	485.9	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.92	0.8	0.62	0.45	0.5	0.74	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.01	20.18	20.42	20.69	20.89	20.98	21	20.99	20.95	20.68	20.28	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.89	0.75	0.54	0.36	0.4	0.66	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.74	18.98	19.33	19.7	19.94	20.03	20.04	20.04	20.01	19.69	19.13	18.67	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.25	19.46	19.76	20.09	20.32	20.41	20.43	20.42	20.38	20.09	19.59	19.19	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.25	19.46	19.76	20.09	20.32	20.41	20.43	20.42	20.38	20.09	19.59	19.19	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.89	0.76	0.57	0.4	0.44	0.69	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	509.43	587.21	642.85	655.77	584.23	423.87	284.42	298.47	442.72	526.83	500.68	482.91	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1116.1	1087.16	990.35	835.82	643.78	433.8	285.59	300.42	469.01	708.49	932.8	1119.18	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	451.37	335.96	258.55	129.64	44.31	0	0	0	0	135.15	311.12	473.39	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 2139.48 (98)

Space heating requirement in kWh/m²/year 29.97 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2139.48	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2246.45	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2040.7	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2142.74	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.89	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.2	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	46.2	(331)
Energy for lighting (calculated in Appendix L)		316.23	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1019.43	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	22.78	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1042.21	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1042.21	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	23.98	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	164.12	(379)
Total CO2, kg/year	sum of (376)…(382) =			1230.3	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			17.23	(384)
EI rating (section 14)				85.84	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-9-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.39	(1a) x	2.4	(2a) =	171.34	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.39	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		171.34	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.43	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.06	x1/[1/(1.4)+ 0.04]		=	6.71			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	40.85	13.34	27.51	x	0.18	=	4.95			(29)
Walls Type2	12.13	2.1	10.03	x	0.18	=	1.81			(29)
Roof	71.39	0	71.39	x	0.13	=	9.28			(30)
Total area of elements, m²			124.37							(31)
Party wall			28.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.82 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.9 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 50.72 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	34.27	34.04	33.81	32.74	32.54	31.6	31.6	31.43	31.96	32.54	32.94	33.37	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	84.99	84.76	84.53	83.46	83.26	82.32	82.32	82.15	82.68	83.26	83.66	84.09	

Average = Sum(39)$_{1…12}$ /12= 83.46 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.19	1.19	1.18	1.17	1.17	1.15	1.15	1.15	1.16	1.17	1.17	1.18

Average = Sum(40)$_{1…12}$ /12= 1.17 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.28 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	97.17	93.64	90.1	86.57	83.04	79.5	79.5	83.04	86.57	90.1	93.64	97.17

Total = Sum(44)$_{1…12}$ = 1060.03 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.1	126.03	130.05	113.38	108.79	93.88	86.99	99.83	101.02	117.73	128.51	139.55

Total = Sum(45)$_{1…12}$ = 1389.86 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.61	18.9	19.51	17.01	16.32	14.08	13.05	14.97	15.15	17.66	19.28	20.93	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	190.69	168.12	176.65	158.47	155.39	138.97	133.59	146.42	146.11	164.32	173.6	186.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	190.69	168.12	176.65	158.47	155.39	138.97	133.59	146.42	146.11	164.32	173.6	186.15	

Output from water heater (annual)$_{1…12}$	1938.48	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.19	75.57	80.52	73.77	73.45	67.29	66.2	70.47	69.66	76.42	78.8	83.68	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.16	16.13	13.11	9.93	7.42	6.27	6.77	8.8	11.81	15	17.5	18.66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.52	202.6	197.36	186.19	172.1	158.86	150.01	147.93	153.17	164.34	178.43	191.67	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	(71)

Water heating gains (Table 5)

(72)m=	114.5	112.46	108.22	102.46	98.72	93.46	88.98	94.72	96.75	102.72	109.45	112.47	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	393.37	391.38	378.88	358.78	338.44	318.77	305.95	311.64	321.93	342.24	365.57	382.99	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.06	x	19.64	x	0.63	x	0.7	=	30.37	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)

East	0.9x	1	x	5.06	x	38.42	x	0.63	x	0.7	=	59.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	5.06	x	63.27	x	0.63	x	0.7	=	97.85	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	5.06	x	92.28	x	0.63	x	0.7	=	142.7	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	5.06	x	113.09	x	0.63	x	0.7	=	174.89	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	5.06	x	115.77	x	0.63	x	0.7	=	179.03	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	5.06	x	110.22	x	0.63	x	0.7	=	170.44	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	5.06	x	94.68	x	0.63	x	0.7	=	146.41	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	5.06	x	73.59	x	0.63	x	0.7	=	113.8	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	5.06	x	45.59	x	0.63	x	0.7	=	70.5	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	5.06	x	24.49	x	0.63	x	0.7	=	37.87	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	5.06	x	16.15	x	0.63	x	0.7	=	24.98	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)

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South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	125.81	220.99	315.75	406.5	464.07	463.17	445.62	403.22	347.75	248.27	152.01	106.75	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	519.17	612.37	694.64	765.28	802.5	781.94	751.58	714.86	669.68	590.51	517.59	489.74	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.92	0.82	0.64	0.48	0.52	0.76	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.82	20.01	20.28	20.6	20.84	20.97	20.99	20.99	20.92	20.6	20.15	19.79	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.93	19.93	19.94	19.95	19.96	19.96	19.96	19.95	19.95	19.94	19.94	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.9	0.76	0.55	0.37	0.41	0.68	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.37	18.65	19.04	19.5	19.8	19.94	19.96	19.96	19.89	19.5	18.86	18.34	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.95	19.19	19.54	19.94	20.22	20.35	20.37	20.37	20.3	19.94	19.37	18.92	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.95	19.19	19.54	19.94	20.22	20.35	20.37	20.37	20.3	19.94	19.37	18.92	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.9	0.78	0.58	0.41	0.45	0.71	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	514.95	601.46	666.13	688.12	623.76	457.37	308.25	322.64	473.28	545.65	508.8	486.67	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1245.39	1211.35	1101.96	921.32	709.3	473.19	310.42	326.11	512.99	777.59	1026.97	1237.54	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	543.45	409.84	324.25	167.91	63.64	0	0	0	0	172.56	373.08	558.65	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 2613.38 | (98)

Space heating requirement in kWh/m²/year | 36.61 | (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	543.45	409.84	324.25	167.91	63.64	0	0	0	0	172.56	373.08	558.65		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	581.23	438.33	346.79	179.58	68.06	0	0	0	0	184.56	399.02	597.48		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2795.06	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	190.69	168.12	176.65	158.47	155.39	138.97	133.59	146.42	146.11	164.32	173.6	186.15		
Efficiency of water heater													79.8	(216)
(217)m=	87.45	87.1	86.41	84.97	82.64	79.8	79.8	79.8	79.8	84.94	86.8	87.57		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	218.05	193.01	204.42	186.51	188.03	174.15	167.4	183.49	183.1	193.45	199.99	212.58		
Total = Sum(219a)$_{1...12}$ =													2304.17	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2795.06	
Water heating fuel used			2304.17	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			320.62	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	603.73	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	497.7	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1101.43	(265)

TER WorkSheet: New dwelling design stage

Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	166.4	(268)
Total CO2, kg/year		sum of (265)…(271) =		1306.76	(272)

TER =	18.3	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-9-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.1	(1a) x	2.4	(2a) =	177.84	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.1	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	177.84	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.98	x1/[1/(1.2)+ 0.04]		=	6.85			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	47.4	16.1	31.3	x	0.18	=	5.63			(29)
Walls Type2	26.78	2.1	24.68	x	0.18	=	4.44			(29)
Roof	74.1	0	74.1	x	0.11	=	8.15			(30)
Total area of elements, m²			148.28							(31)
Party wall			20.62	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.18 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.12 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 54.31 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	83.65	83.65	83.65	83.65	83.65	83.65	83.65	83.65	83.65	83.65	83.65	83.65	

Average = $Sum(39)_{1...12}$ /12= 83.65 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	

Average = $Sum(40)_{1...12}$ /12= 1.13 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.34 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.81 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	98.79	95.2	91.6	88.01	84.42	80.83	80.83	84.42	88.01	91.6	95.2	98.79	

Total = $Sum(44)_{1...12}$ = 1077.7 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.5	128.13	132.22	115.27	110.61	95.45	88.44	101.49	102.7	119.69	130.65	141.88	

Total = $Sum(45)_{1...12}$ = 1413.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.98	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.41	17.95	19.6	21.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.78	178.06	187.5	168.77	165.88	148.94	143.72	156.77	156.2	174.97	184.15	197.16	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.78	178.06	187.5	168.77	165.88	148.94	143.72	156.77	156.2	174.97	184.15	197.16

Output from water heater (annual)$_{1...12}$ — 2063.88 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.93	82.55	88.18	81.12	81	74.53	73.63	77.97	76.94	84.02	86.24	91.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.42	16.36	13.31	10.08	7.53	6.36	6.87	8.93	11.99	15.22	17.76	18.94	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	206.67	208.82	203.41	191.91	177.38	163.73	154.61	152.47	157.87	169.38	183.9	197.55	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	(71)

Water heating gains (Table 5)

(72)m=	124.91	122.84	118.53	112.67	108.87	103.51	98.96	104.79	106.87	112.93	119.77	122.84	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	408.13	406.14	393.37	372.77	351.9	331.73	318.57	324.32	334.85	355.65	379.56	397.45	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

South	0.9x	0.77	x	5.98	x	46.75	x	0.5	x	0.8	=	77.5	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	5.98	x	76.57	x	0.5	x	0.8	=	126.92	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	5.98	x	97.53	x	0.5	x	0.8	=	161.68	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	5.98	x	110.23	x	0.5	x	0.8	=	182.73	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	5.98	x	114.87	x	0.5	x	0.8	=	190.42	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	5.98	x	110.55	x	0.5	x	0.8	=	183.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	5.98	x	108.01	x	0.5	x	0.8	=	179.05	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	5.98	x	104.89	x	0.5	x	0.8	=	173.88	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	5.98	x	101.89	x	0.5	x	0.8	=	168.89	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	5.98	x	82.59	x	0.5	x	0.8	=	136.9	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	5.98	x	55.42	x	0.5	x	0.8	=	91.86	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	5.98	x	40.4	x	0.5	x	0.8	=	66.97	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)

West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	153.34	263.89	365.39	455.34	509.03	504.02	486.55	447.29	396.98	293.09	184.22	130.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	561.47	670.03	758.76	828.11	860.94	835.75	805.12	771.6	731.83	648.74	563.78	528.28	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.91	0.79	0.62	0.45	0.49	0.72	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.13	20.39	20.67	20.88	20.97	21	20.99	20.94	20.66	20.23	19.88	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.88	0.73	0.53	0.35	0.39	0.64	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.57	18.85	19.22	19.61	19.86	19.96	19.98	19.97	19.93	19.61	19	18.5	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.12	19.36	19.69	20.03	20.27	20.37	20.38	20.38	20.34	20.03	19.49	19.05	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.12	19.36	19.69	20.03	20.27	20.37	20.38	20.38	20.34	20.03	19.49	19.05	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.88	0.75	0.56	0.39	0.43	0.67	0.91	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	556.01	654.94	719.67	729.53	646.78	469.49	314.84	330.46	491.15	587.74	551.99	524.39	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1239.38	1209.73	1103.23	931.17	716.81	482.28	316.49	333.08	521.66	788.83	1036.63	1242.25	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	508.42	372.82	285.37	145.18	52.1	0	0	0	0	149.61	348.94	534.09	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2396.54 (98)

Space heating requirement in kWh/m²/year 32.34 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2396.54	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2516.36	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2063.88	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2167.07	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	46.83	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.95	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			47.95	(331)
Energy for lighting (calculated in Appendix L)				325.39	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1087.77	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	24.31	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1112.07	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1112.07	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	24.89	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	168.88	(379)
Total CO2, kg/year	sum of (376)…(382) =				1305.84	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17.62	(384)
EI rating (section 14)					85.31	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-9-03

Address :	Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	74.1	(1a)	x	2.4	(2a)	=	177.84	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.1	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		177.84	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.98	x1/[1/(1.4)+ 0.04]		=	7.93			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 5			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	47.4	16.1	31.3	x	0.18	=	5.63			(29)
Walls Type2	26.78	2.1	24.68	x	0.18	=	4.44			(29)
Roof	74.1	0	74.1	x	0.13	=	9.63			(30)
Total area of elements, m²			148.28							(31)
Party wall			20.62	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 43.15 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 17.19 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 60.34 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.39	35.15	34.92	33.84	33.64	32.7	32.7	32.52	33.06	33.64	34.05	34.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	95.73	95.49	95.26	94.18	93.98	93.04	93.04	92.87	93.4	93.98	94.39	94.82	

Average = Sum(39)$_{1\ldots12}$ /12= 94.18 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.29	1.29	1.29	1.27	1.27	1.26	1.26	1.25	1.26	1.27	1.27	1.28	

Average = Sum(40)$_{1\ldots12}$ /12= 1.27 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.34 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.81 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	98.79	95.2	91.6	88.01	84.42	80.83	80.83	84.42	88.01	91.6	95.2	98.79	

Total = Sum(44)$_{1\ldots12}$ = 1077.7 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.5	128.13	132.22	115.27	110.61	95.45	88.44	101.49	102.7	119.69	130.65	141.88	

Total = Sum(45)$_{1\ldots12}$ = 1413.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.98	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.41	17.95	19.6	21.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	193.1	170.22	178.82	160.36	157.2	140.54	135.04	148.09	147.8	166.29	175.74	188.47	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	193.1	170.22	178.82	160.36	157.2	140.54	135.04	148.09	147.8	166.29	175.74	188.47

Output from water heater (annual)$_{1...12}$ | 1961.66 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.99	76.27	81.24	74.4	74.05	67.81	66.68	71.02	70.22	77.07	79.52	84.45	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.44	16.38	13.32	10.08	7.54	6.36	6.88	8.94	12	15.23	17.78	18.95	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	206.67	208.82	203.41	191.91	177.38	163.73	154.61	152.47	157.87	169.38	183.9	197.55	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	(71)

Water heating gains (Table 5)

(72)m=	115.58	113.5	109.19	103.34	99.53	94.18	89.63	95.46	97.53	103.59	110.44	113.51	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	401.81	399.82	387.04	366.45	345.58	325.4	312.24	317.99	328.52	349.33	373.24	391.13	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	5.98	x	46.75	x	0.63	x	0.7	=	85.44	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	5.98	x	76.57	x	0.63	x	0.7	=	139.93	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	5.98	x	97.53	x	0.63	x	0.7	=	178.25	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	5.98	x	110.23	x	0.63	x	0.7	=	201.46	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	5.98	x	114.87	x	0.63	x	0.7	=	209.93	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	5.98	x	110.55	x	0.63	x	0.7	=	202.03	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	5.98	x	108.01	x	0.63	x	0.7	=	197.4	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	5.98	x	104.89	x	0.63	x	0.7	=	191.7	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	5.98	x	101.89	x	0.63	x	0.7	=	186.2	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	5.98	x	82.59	x	0.63	x	0.7	=	150.93	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	5.98	x	55.42	x	0.63	x	0.7	=	101.28	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	5.98	x	40.4	x	0.63	x	0.7	=	73.83	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)

West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	169.05	290.94	402.84	502.01	561.21	555.68	536.42	493.13	437.67	323.14	203.11	144.23	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	570.86	690.75	789.88	868.46	906.78	881.08	848.66	811.12	766.19	672.46	576.35	535.37	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.91	0.81	0.64	0.47	0.51	0.75	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.73	19.94	20.24	20.57	20.82	20.96	20.99	20.99	20.91	20.57	20.08	19.69	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.85	19.85	19.85	19.86	19.87	19.88	19.88	19.88	19.87	19.87	19.86	19.86	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.89	0.75	0.54	0.36	0.39	0.66	0.91	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.18	18.49	18.91	19.39	19.7	19.85	19.87	19.87	19.81	19.4	18.7	18.13	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.8	19.07	19.44	19.86	20.15	20.29	20.32	20.32	20.25	19.87	19.25	18.75	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.8	19.07	19.44	19.86	20.15	20.29	20.32	20.32	20.25	19.87	19.25	18.75	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.89	0.76	0.58	0.4	0.44	0.69	0.91	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	565.09	674.98	750	769.23	693.3	509.05	343.05	359.2	527.8	612.5	564.29	531.21	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1387.86	1353.32	1232.93	1032.23	794.35	529.63	346.13	363.91	574.23	870.8	1147.16	1379.89	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	612.14	455.85	359.3	189.36	75.18	0	0	0	0	192.18	419.67	631.41	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2935.08 (98)

Space heating requirement in kWh/m²/year 39.61 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	612.14	455.85	359.3	189.36	75.18	0	0	0	0	192.18	419.67	631.41	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	654.7	487.54	384.28	202.52	80.4	0	0	0	0	205.54	448.84	675.31	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3139.12 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	193.1	170.22	178.82	160.36	157.2	140.54	135.04	148.09	147.8	166.29	175.74	188.47	
Efficiency of water heater												79.8	(216)
(217)m=	87.68	87.32	86.64	85.26	82.97	79.8	79.8	79.8	79.8	85.2	87.05	87.79	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	220.23	194.94	206.39	188.09	189.46	176.11	169.22	185.57	185.21	195.17	201.88	214.68	

Total = Sum(219a)$_{1...12}$ = 2326.95 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3139.12

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Water heating fuel used			2326.95	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			325.65	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	678.05	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	502.62	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1180.67	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	169.01	(268)
Total CO2, kg/year		sum of (265)…(271) =		1388.61	(272)

TER = 18.74 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-9-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	92.47	(1a) x	2.4	(2a) =	221.93	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.47	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	221.93	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x 1.2	= 2.52			(26)
Windows Type 1			8.51	x1/[1/(1.2)+ 0.04]	= 9.74			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]	= 3.16			(27)
Windows Type 3			4.48	x1/[1/(1.2)+ 0.04]	= 5.13			(27)
Windows Type 4			0.01	x1/[1/(1.2)+ 0.04]	= 0.01			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]	= 3.16			(27)
Windows Type 6			2.76	x1/[1/(1.2)+ 0.04]	= 3.16			(27)
Windows Type 7			2.76	x1/[1/(1.2)+ 0.04]	= 3.16			(27)
Walls Type1	55.39	24.04	31.35	x 0.18	= 5.64			(29)
Walls Type2	33.78	2.1	31.68	x 0.18	= 5.7			(29)
Roof	92.47	0	92.47	x 0.11	= 10.17			(30)
Total area of elements, m²			181.64					(31)
Party wall			21.6	x 0	= 0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	51.56	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	17.41	(36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 68.98 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	105.6	105.6	105.6	105.6	105.6	105.6	105.6	105.6	105.6	105.6	105.6	105.6	

Average = Sum(39)$_{1…12}$ /12= 105.6 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	

Average = Sum(40)$_{1…12}$ /12= 1.14 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.66 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.33 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	107.06	103.17	99.28	95.38	91.49	87.6	87.6	91.49	95.38	99.28	103.17	107.06	

Total = Sum(44)$_{1…12}$ = 1167.94 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.77	138.86	143.29	124.92	119.87	103.44	95.85	109.99	111.3	129.71	141.59	153.76	

Total = Sum(45)$_{1…12}$ = 1531.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.82	20.83	21.49	18.74	17.98	15.52	14.38	16.5	16.7	19.46	21.24	23.06	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	214.05	188.79	198.57	178.42	175.15	156.93	151.13	165.27	164.8	184.99	195.09	209.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	214.05	188.79	198.57	178.42	175.15	156.93	151.13	165.27	164.8	184.99	195.09	209.04	

Output from water heater (annual)$_{1...12}$ | 2182.2 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	97.01	86.11	91.87	84.33	84.08	77.19	76.09	80.79	79.8	87.35	89.87	95.35	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.71	19.28	15.68	11.87	8.88	7.49	8.1	10.52	14.13	17.94	20.93	22.32	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	243.55	246.08	239.71	226.15	209.03	192.95	182.2	179.68	186.04	199.6	216.72	232.8	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	(71)

Water heating gains (Table 5)

(72)m=	130.39	128.14	123.48	117.13	113.01	107.21	102.27	108.59	110.84	117.41	124.83	128.15	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	458.53	456.38	441.74	418.02	393.79	370.52	355.44	361.66	373.88	397.82	425.35	446.14	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	8.51	x	10.63	x	0.5	x	0.8	=	25.08	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	8.51	x	20.32	x	0.5	x	0.8	=	47.94	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	8.51	x	34.53	x	0.5	x	0.8	=	81.46	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	8.51	x	55.46	x	0.5	x	0.8	=	130.84	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	8.51	x	74.72	x	0.5	x	0.8	=	176.25	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	8.51	x	79.99	x	0.5	x	0.8	=	188.68	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	8.51	x	74.68	x	0.5	x	0.8	=	176.16	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	8.51	x	59.25	x	0.5	x	0.8	=	139.76	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	8.51	x	41.52	x	0.5	x	0.8	=	97.94	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	8.51	x	24.19	x	0.5	x	0.8	=	57.06	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	8.51	x	13.12	x	0.5	x	0.8	=	30.94	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	8.51	x	8.86	x	0.5	x	0.8	=	20.91	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
South	0.9x	0.77	x	0.01	x	46.75	x	0.5	x	0.8	=	0.13	(78)
South	0.9x	0.77	x	0.01	x	76.57	x	0.5	x	0.8	=	0.21	(78)
South	0.9x	0.77	x	0.01	x	97.53	x	0.5	x	0.8	=	0.27	(78)

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South	0.9x	0.77	x	0.01	x	110.23	x	0.5	x	0.8	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	114.87	x	0.5	x	0.8	=	0.32	(78)
South	0.9x	0.77	x	0.01	x	110.55	x	0.5	x	0.8	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	108.01	x	0.5	x	0.8	=	0.3	(78)
South	0.9x	0.77	x	0.01	x	104.89	x	0.5	x	0.8	=	0.29	(78)
South	0.9x	0.77	x	0.01	x	101.89	x	0.5	x	0.8	=	0.28	(78)
South	0.9x	0.77	x	0.01	x	82.59	x	0.5	x	0.8	=	0.23	(78)
South	0.9x	0.77	x	0.01	x	55.42	x	0.5	x	0.8	=	0.15	(78)
South	0.9x	0.77	x	0.01	x	40.4	x	0.5	x	0.8	=	0.11	(78)
West	0.9x	0.77	x	4.48	x	19.64	x	0.5	x	0.8	=	24.39	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	4.48	x	38.42	x	0.5	x	0.8	=	47.71	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	4.48	x	63.27	x	0.5	x	0.8	=	78.58	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	4.48	x	92.28	x	0.5	x	0.8	=	114.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	4.48	x	113.09	x	0.5	x	0.8	=	140.44	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	4.48	x	115.77	x	0.5	x	0.8	=	143.77	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	4.48	x	110.22	x	0.5	x	0.8	=	136.88	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	4.48	x	94.68	x	0.5	x	0.8	=	117.57	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	4.48	x	73.59	x	0.5	x	0.8	=	91.39	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	4.48	x	45.59	x	0.5	x	0.8	=	56.62	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	4.48	x	24.49	x	0.5	x	0.8	=	30.41	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)

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West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	4.48	x	16.15	x	0.5	x	0.8	=	20.06	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	95.93	185.74	309.96	471.81	604.39	632.29	596.25	493.15	365.73	220.68	119.05	79.36	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	554.45	642.12	751.69	889.84	998.18	1002.81	951.69	854.81	739.61	618.49	544.4	525.5	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.83	0.64	0.48	0.55	0.83	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.77	19.92	20.2	20.56	20.84	20.97	20.99	20.99	20.88	20.5	20.06	19.73	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.77	0.55	0.37	0.44	0.75	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.33	18.55	18.95	19.45	19.82	19.95	19.96	19.96	19.87	19.38	18.75	18.27	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.9	19.1	19.45	19.89	20.23	20.35	20.38	20.37	20.28	19.83	19.27	18.85	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.9	19.1	19.45	19.89	20.23	20.35	20.38	20.37	20.28	19.83	19.27	18.85	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.92	0.79	0.59	0.42	0.48	0.78	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	552.43	637.04	734.78	822.11	787.6	587.6	395.87	413.5	575.66	594.23	540.3	524.02	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1542.04	1499.12	1367.1	1160.91	900.45	607.59	398.74	419.42	652.28	974.32	1285.39	1547.23	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	736.27	579.32	470.44	243.94	83.96	0	0	0	0	282.79	536.47	761.27	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3694.45 (98)

Space heating requirement in kWh/m²/year 39.95 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		3694.45	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	3879.17	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2182.2	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2291.31	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	61.7	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		59.84	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	59.84	(331)
Energy for lighting (calculated in Appendix L)		383.45	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1433.14	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	32.02	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1465.17	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1465.17	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	31.06	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	199.01	(379)
Total CO2, kg/year	sum of (376)…(382) =			1695.23	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.33	(384)
EI rating (section 14)				83.48	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: a1-9-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	92.47	(1a) x	2.4	(2a) =	221.93	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.47	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	221.93	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.39	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			7.44	x1/[1/(1.4)+ 0.04]		=	9.86			(27)
Windows Type 2			2.41	x1/[1/(1.4)+ 0.04]		=	3.2			(27)
Windows Type 3			3.92	x1/[1/(1.4)+ 0.04]		=	5.2			(27)
Windows Type 4			0.01	x1/[1/(1.4)+ 0.04]		=	0.01			(27)
Windows Type 5			2.41	x1/[1/(1.4)+ 0.04]		=	3.2			(27)
Windows Type 6			2.41	x1/[1/(1.4)+ 0.04]		=	3.2			(27)
Windows Type 7			2.41	x1/[1/(1.4)+ 0.04]		=	3.2			(27)
Walls Type1	55.39	21.01	34.38	x	0.18	=	6.19			(29)
Walls Type2	33.78	2.1	31.68	x	0.18	=	5.7			(29)
Roof	92.47	0	92.47	x	0.13	=	12.02			(30)
Total area of elements, m²			181.64							(31)
Party wall			21.6	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 53.87 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 21.64 (36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 75.51 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	43	42.75	42.51	41.37	41.15	40.16	40.16	39.98	40.54	41.15	41.59	42.04	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	118.51	118.26	118.02	116.87	116.66	115.67	115.67	115.48	116.05	116.66	117.09	117.54	

Average = Sum(39)$_{1...12}$ /12= 116.87 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.28	1.28	1.28	1.26	1.26	1.25	1.25	1.25	1.26	1.26	1.27	1.27	

Average = Sum(40)$_{1...12}$ /12= 1.26 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.66 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.33 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	107.06	103.17	99.28	95.38	91.49	87.6	87.6	91.49	95.38	99.28	103.17	107.06

Total = Sum(44)$_{1...12}$ = 1167.94 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.77	138.86	143.29	124.92	119.87	103.44	95.85	109.99	111.3	129.71	141.59	153.76

Total = Sum(45)$_{1...12}$ = 1531.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.82	20.83	21.49	18.74	17.98	15.52	14.38	16.5	16.7	19.46	21.24	23.06	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.36	180.95	189.89	170.02	166.46	148.53	142.44	156.58	156.39	176.31	186.68	200.35	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.36	180.95	189.89	170.02	166.46	148.53	142.44	156.58	156.39	176.31	186.68	200.35	

Output from water heater (annual)$_{1...12}$ 2079.97 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.07	79.84	84.92	77.61	77.13	70.47	69.15	73.85	73.08	80.41	83.15	88.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.71	19.28	15.68	11.87	8.88	7.49	8.1	10.52	14.13	17.94	20.93	22.32	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	243.55	246.08	239.71	226.15	209.03	192.95	182.2	179.68	186.04	199.6	216.72	232.8	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	(71)

Water heating gains (Table 5)

(72)m=	121.06	118.81	114.14	107.79	103.67	97.87	92.94	99.26	101.5	108.07	115.49	118.82	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	452.19	450.04	435.4	411.69	387.45	364.18	349.11	355.33	367.54	391.48	419.01	439.81	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	7.44	x	10.63	x	0.63	x	0.7	=	24.18	(74)
North	0.9x	0.77	x	2.41	x	10.63	x	0.63	x	0.7	=	7.83	(74)
North	0.9x	0.77	x	2.41	x	10.63	x	0.63	x	0.7	=	7.83	(74)
North	0.9x	0.77	x	7.44	x	20.32	x	0.63	x	0.7	=	46.2	(74)
North	0.9x	0.77	x	2.41	x	20.32	x	0.63	x	0.7	=	14.97	(74)
North	0.9x	0.77	x	2.41	x	20.32	x	0.63	x	0.7	=	14.97	(74)
North	0.9x	0.77	x	7.44	x	34.53	x	0.63	x	0.7	=	78.51	(74)
North	0.9x	0.77	x	2.41	x	34.53	x	0.63	x	0.7	=	25.43	(74)
North	0.9x	0.77	x	2.41	x	34.53	x	0.63	x	0.7	=	25.43	(74)
North	0.9x	0.77	x	7.44	x	55.46	x	0.63	x	0.7	=	126.11	(74)
North	0.9x	0.77	x	2.41	x	55.46	x	0.63	x	0.7	=	40.85	(74)
North	0.9x	0.77	x	2.41	x	55.46	x	0.63	x	0.7	=	40.85	(74)
North	0.9x	0.77	x	7.44	x	74.72	x	0.63	x	0.7	=	169.89	(74)
North	0.9x	0.77	x	2.41	x	74.72	x	0.63	x	0.7	=	55.03	(74)
North	0.9x	0.77	x	2.41	x	74.72	x	0.63	x	0.7	=	55.03	(74)
North	0.9x	0.77	x	7.44	x	79.99	x	0.63	x	0.7	=	181.87	(74)
North	0.9x	0.77	x	2.41	x	79.99	x	0.63	x	0.7	=	58.91	(74)
North	0.9x	0.77	x	2.41	x	79.99	x	0.63	x	0.7	=	58.91	(74)
North	0.9x	0.77	x	7.44	x	74.68	x	0.63	x	0.7	=	169.8	(74)
North	0.9x	0.77	x	2.41	x	74.68	x	0.63	x	0.7	=	55	(74)
North	0.9x	0.77	x	2.41	x	74.68	x	0.63	x	0.7	=	55	(74)
North	0.9x	0.77	x	7.44	x	59.25	x	0.63	x	0.7	=	134.71	(74)
North	0.9x	0.77	x	2.41	x	59.25	x	0.63	x	0.7	=	43.64	(74)
North	0.9x	0.77	x	2.41	x	59.25	x	0.63	x	0.7	=	43.64	(74)
North	0.9x	0.77	x	7.44	x	41.52	x	0.63	x	0.7	=	94.4	(74)
North	0.9x	0.77	x	2.41	x	41.52	x	0.63	x	0.7	=	30.58	(74)
North	0.9x	0.77	x	2.41	x	41.52	x	0.63	x	0.7	=	30.58	(74)
North	0.9x	0.77	x	7.44	x	24.19	x	0.63	x	0.7	=	55	(74)
North	0.9x	0.77	x	2.41	x	24.19	x	0.63	x	0.7	=	17.82	(74)
North	0.9x	0.77	x	2.41	x	24.19	x	0.63	x	0.7	=	17.82	(74)
North	0.9x	0.77	x	7.44	x	13.12	x	0.63	x	0.7	=	29.83	(74)
North	0.9x	0.77	x	2.41	x	13.12	x	0.63	x	0.7	=	9.66	(74)
North	0.9x	0.77	x	2.41	x	13.12	x	0.63	x	0.7	=	9.66	(74)
North	0.9x	0.77	x	7.44	x	8.86	x	0.63	x	0.7	=	20.16	(74)
North	0.9x	0.77	x	2.41	x	8.86	x	0.63	x	0.7	=	6.53	(74)
North	0.9x	0.77	x	2.41	x	8.86	x	0.63	x	0.7	=	6.53	(74)
South	0.9x	0.77	x	0.01	x	46.75	x	0.63	x	0.7	=	0.14	(78)
South	0.9x	0.77	x	0.01	x	76.57	x	0.63	x	0.7	=	0.23	(78)
South	0.9x	0.77	x	0.01	x	97.53	x	0.63	x	0.7	=	0.3	(78)

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South	0.9x	0.77	x	0.01	x	110.23	x	0.63	x	0.7	=	0.34	(78)
South	0.9x	0.77	x	0.01	x	114.87	x	0.63	x	0.7	=	0.35	(78)
South	0.9x	0.77	x	0.01	x	110.55	x	0.63	x	0.7	=	0.34	(78)
South	0.9x	0.77	x	0.01	x	108.01	x	0.63	x	0.7	=	0.33	(78)
South	0.9x	0.77	x	0.01	x	104.89	x	0.63	x	0.7	=	0.32	(78)
South	0.9x	0.77	x	0.01	x	101.89	x	0.63	x	0.7	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	82.59	x	0.63	x	0.7	=	0.25	(78)
South	0.9x	0.77	x	0.01	x	55.42	x	0.63	x	0.7	=	0.17	(78)
South	0.9x	0.77	x	0.01	x	40.4	x	0.63	x	0.7	=	0.12	(78)
West	0.9x	0.77	x	3.92	x	19.64	x	0.63	x	0.7	=	23.53	(80)
West	0.9x	0.77	x	2.41	x	19.64	x	0.63	x	0.7	=	14.47	(80)
West	0.9x	0.77	x	2.41	x	19.64	x	0.63	x	0.7	=	14.47	(80)
West	0.9x	0.77	x	3.92	x	38.42	x	0.63	x	0.7	=	46.03	(80)
West	0.9x	0.77	x	2.41	x	38.42	x	0.63	x	0.7	=	28.3	(80)
West	0.9x	0.77	x	2.41	x	38.42	x	0.63	x	0.7	=	28.3	(80)
West	0.9x	0.77	x	3.92	x	63.27	x	0.63	x	0.7	=	75.8	(80)
West	0.9x	0.77	x	2.41	x	63.27	x	0.63	x	0.7	=	46.6	(80)
West	0.9x	0.77	x	2.41	x	63.27	x	0.63	x	0.7	=	46.6	(80)
West	0.9x	0.77	x	3.92	x	92.28	x	0.63	x	0.7	=	110.55	(80)
West	0.9x	0.77	x	2.41	x	92.28	x	0.63	x	0.7	=	67.97	(80)
West	0.9x	0.77	x	2.41	x	92.28	x	0.63	x	0.7	=	67.97	(80)
West	0.9x	0.77	x	3.92	x	113.09	x	0.63	x	0.7	=	135.49	(80)
West	0.9x	0.77	x	2.41	x	113.09	x	0.63	x	0.7	=	83.3	(80)
West	0.9x	0.77	x	2.41	x	113.09	x	0.63	x	0.7	=	83.3	(80)
West	0.9x	0.77	x	3.92	x	115.77	x	0.63	x	0.7	=	138.69	(80)
West	0.9x	0.77	x	2.41	x	115.77	x	0.63	x	0.7	=	85.27	(80)
West	0.9x	0.77	x	2.41	x	115.77	x	0.63	x	0.7	=	85.27	(80)
West	0.9x	0.77	x	3.92	x	110.22	x	0.63	x	0.7	=	132.04	(80)
West	0.9x	0.77	x	2.41	x	110.22	x	0.63	x	0.7	=	81.18	(80)
West	0.9x	0.77	x	2.41	x	110.22	x	0.63	x	0.7	=	81.18	(80)
West	0.9x	0.77	x	3.92	x	94.68	x	0.63	x	0.7	=	113.42	(80)
West	0.9x	0.77	x	2.41	x	94.68	x	0.63	x	0.7	=	69.73	(80)
West	0.9x	0.77	x	2.41	x	94.68	x	0.63	x	0.7	=	69.73	(80)
West	0.9x	0.77	x	3.92	x	73.59	x	0.63	x	0.7	=	88.16	(80)
West	0.9x	0.77	x	2.41	x	73.59	x	0.63	x	0.7	=	54.2	(80)
West	0.9x	0.77	x	2.41	x	73.59	x	0.63	x	0.7	=	54.2	(80)
West	0.9x	0.77	x	3.92	x	45.59	x	0.63	x	0.7	=	54.62	(80)
West	0.9x	0.77	x	2.41	x	45.59	x	0.63	x	0.7	=	33.58	(80)
West	0.9x	0.77	x	2.41	x	45.59	x	0.63	x	0.7	=	33.58	(80)
West	0.9x	0.77	x	3.92	x	24.49	x	0.63	x	0.7	=	29.34	(80)
West	0.9x	0.77	x	2.41	x	24.49	x	0.63	x	0.7	=	18.04	(80)

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West	0.9x	0.77	x	2.41	x	24.49	x	0.63	x	0.7	=	18.04	(80)
West	0.9x	0.77	x	3.92	x	16.15	x	0.63	x	0.7	=	19.35	(80)
West	0.9x	0.77	x	2.41	x	16.15	x	0.63	x	0.7	=	11.9	(80)
West	0.9x	0.77	x	2.41	x	16.15	x	0.63	x	0.7	=	11.9	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	92.44	179	298.68	454.64	582.37	609.26	574.53	475.19	352.43	212.66	114.73	76.48	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	544.63	629.04	734.08	866.32	969.83	973.44	923.64	830.52	719.97	604.14	533.74	516.29	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.87	0.7	0.54	0.61	0.87	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.58	19.73	20.02	20.42	20.76	20.94	20.99	20.97	20.82	20.38	19.91	19.55	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.86	19.86	19.86	19.87	19.87	19.88	19.88	19.88	19.88	19.87	19.87	19.86	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.82	0.6	0.41	0.48	0.79	0.97	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.97	18.2	18.62	19.19	19.64	19.84	19.87	19.87	19.73	19.15	18.46	17.93	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.61	18.81	19.18	19.68	20.08	20.28	20.32	20.31	20.17	19.64	19.04	18.58	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.61	18.81	19.18	19.68	20.08	20.28	20.32	20.31	20.17	19.64	19.04	18.58	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.83	0.64	0.46	0.53	0.81	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	542.67	624.44	719.97	812.72	802.14	619.27	423.76	439.72	586.76	584.17	530	514.83	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1695.87	1645.03	1496.34	1260.05	978.09	656.89	430.17	451.83	704.21	1054.82	1398.31	1690.32	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	857.99	685.83	577.61	322.08	130.91	0	0	0	0	350.17	625.18	874.57	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 4424.34 (98)

Space heating requirement in kWh/m²/year 47.85 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system			0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =		1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =		1	(204)
Efficiency of main space heating system 1			93.5	(206)
Efficiency of secondary/supplementary heating system, %			0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	857.99	685.83	577.61	322.08	130.91	0	0	0	0	350.17	625.18	874.57		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	917.63	733.51	617.77	344.47	140.01	0	0	0	0	374.51	668.64	935.37		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													4731.91	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)
Water heating														
Output from water heater (calculated above)	205.36	180.95	189.89	170.02	166.46	148.53	142.44	156.58	156.39	176.31	186.68	200.35		
Efficiency of water heater													79.8	(216)
(217)m=	88.22	88.04	87.59	86.49	84.18	79.8	79.8	79.8	79.8	86.61	87.79	88.29		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	232.8	205.54	216.78	196.57	197.74	186.13	178.5	196.22	195.98	203.56	212.64	226.92		
Total = Sum(219a)$_{1...12}$ =													2449.38	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			4731.91	
Water heating fuel used			2449.38	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			383.45	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1022.09	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	529.07	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1551.16	(265)

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Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	199.01	(268)
Total CO2, kg/year			sum of (265)…(271) =		1789.1	(272)

TER = 19.35 (273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-10-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	54.19	(1a) x	2.4	(2a) =	130.06	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54.19	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		130.06	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	40.99	15.64	25.35	x	0.18	=	4.56			(29)
Walls Type2	24.59	2.1	22.49	x	0.18	=	4.05			(29)
Roof	54.19	0	54.19	x	0.11	=	5.96			(30)
Total area of elements, m²			119.77							(31)
Party wall			16.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 16.32 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 51.32 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	21.46	21.46	21.46	21.46	21.46	21.46	21.46	21.46	21.46	21.46	21.46	21.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	72.78	72.78	72.78	72.78	72.78	72.78	72.78	72.78	72.78	72.78	72.78	72.78	

Average = Sum(39)$_{1…12}$ /12= 72.78 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	

Average = Sum(40)$_{1…12}$ /12= 1.34 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.81 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.27 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	85	81.91	78.82	75.73	72.64	69.55	69.55	72.64	75.73	78.82	81.91	85	

Total = Sum(44)$_{1…12}$ = 927.27 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	126.05	110.25	113.76	99.18	95.17	82.12	76.1	87.32	88.37	102.98	112.41	122.08	

Total = Sum(45)$_{1…12}$ = 1215.8 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.91	16.54	17.06	14.88	14.28	12.32	11.41	13.1	13.26	15.45	16.86	18.31	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.33	160.17	169.04	152.68	150.44	135.62	131.38	142.6	141.86	158.26	165.91	177.35	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.33	160.17	169.04	152.68	150.44	135.62	131.38	142.6	141.86	158.26	165.91	177.35

Output from water heater (annual)$_{1...12}$ | 1866.64 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.13	76.6	82.05	75.77	75.86	70.1	69.52	73.26	72.18	78.46	80.17	84.81	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.09	12.52	10.18	7.71	5.76	4.86	5.26	6.83	9.17	11.64	13.59	14.49	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	158.1	159.74	155.6	146.8	135.69	125.25	118.27	116.63	120.77	129.57	140.68	151.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	(71)

Water heating gains (Table 5)

(72)m=	115.77	113.99	110.28	105.24	101.97	97.36	93.45	98.46	100.25	105.46	111.35	113.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	338.17	336.44	326.27	309.95	293.63	277.68	267.18	272.13	280.39	296.88	315.82	329.8	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)

North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
East	0.9x	1	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(76)
East	0.9x	1	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	57.58	111.18	186.35	287.41	372.86	392.4	369.07	302.03	220.89	132.16	71.37	47.72	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	395.75	447.62	512.62	597.36	666.48	670.08	636.25	574.17	501.27	429.04	387.19	377.53	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.82	0.65	0.49	0.56	0.82	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.62	19.78	20.07	20.46	20.78	20.95	20.99	20.98	20.85	20.43	19.95	19.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.91	0.76	0.55	0.36	0.43	0.73	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18	18.23	18.65	19.2	19.61	19.77	19.8	19.8	19.69	19.16	18.48	17.94	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.81	19.01	19.36	19.83	20.2	20.36	20.4	20.39	20.27	19.79	19.21	18.76	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.81	19.01	19.36	19.83	20.2	20.36	20.4	20.39	20.27	19.79	19.21	18.76	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.78	0.59	0.43	0.49	0.77	0.95	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	392.59	441.26	496.07	544.64	522.91	398.04	272.34	283.18	385.32	405.61	381.54	375.05	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1056.32	1026.63	936.16	795.31	618.35	419.16	276.2	290.26	448.83	668.97	881.56	1059.84	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	493.81	393.37	327.42	180.49	71.01	0	0	0	0	195.94	360.02	509.48	

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2531.55	(98)
Space heating requirement in kWh/m²/year		46.72	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2531.55	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2658.13	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1866.64	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1959.97	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	46.18	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		35.07	(330a)

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warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =		35.07	(331)
Energy for lighting (calculated in Appendix L)			248.91	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	1072.59	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	23.97	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1096.56	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1096.56	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	18.2	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	129.18	(379)
Total CO2, kg/year	sum of (376)…(382) =			1243.94	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			22.96	(384)
EI rating (section 14)				83.2	(385)

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User Details:

Assessor Name: **Stroma Number:**
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.8

Property Address: b1-10-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	54.19	(1a) x	2.4	(2a) =	130.06	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54.19	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	130.06	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.02	x1/[1/(1.4)+ 0.04]		=	2.68			(27)
Windows Type 2			3.37	x1/[1/(1.4)+ 0.04]		=	4.47			(27)
Windows Type 3			2.02	x1/[1/(1.4)+ 0.04]		=	2.68			(27)
Windows Type 4			2.02	x1/[1/(1.4)+ 0.04]		=	2.68			(27)
Windows Type 5			2.02	x1/[1/(1.4)+ 0.04]		=	2.68			(27)
Walls Type1	40.99	11.45	29.54	x	0.18	=	5.32			(29)
Walls Type2	24.59	2.1	22.49	x	0.18	=	4.05			(29)
Roof	54.19	0	54.19	x	0.13	=	7.04			(30)
Total area of elements, m²			119.77							(31)
Party wall			16.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.69 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 18.25 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 51.94 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.57	25.41	25.25	24.52	24.38	23.74	23.74	23.62	23.99	24.38	24.66	24.95	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	77.51	77.35	77.19	76.45	76.32	75.68	75.68	75.56	75.92	76.32	76.6	76.89	

Average = $Sum(39)_{1...12}$ /12= 76.45 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.43	1.43	1.42	1.41	1.41	1.4	1.4	1.39	1.4	1.41	1.41	1.42	

Average = $Sum(40)_{1...12}$ /12= 1.41 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.81 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.27 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	85	81.91	78.82	75.73	72.64	69.55	69.55	72.64	75.73	78.82	81.91	85	

Total = $Sum(44)_{1...12}$ = 927.27 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	126.05	110.25	113.76	99.18	95.17	82.12	76.1	87.32	88.37	102.98	112.41	122.08	

Total = $Sum(45)_{1...12}$ = 1215.8 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.91	16.54	17.06	14.88	14.28	12.32	11.41	13.1	13.26	15.45	16.86	18.31	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	172.65	152.33	160.36	144.27	141.76	127.21	122.69	133.92	133.46	149.58	157.51	168.67	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	172.65	152.33	160.36	144.27	141.76	127.21	122.69	133.92	133.46	149.58	157.51	168.67

Output from water heater (annual)$_{1…12}$ — 1764.42 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	79.19	70.33	75.1	69.05	68.92	63.38	62.58	66.31	65.46	71.52	73.45	77.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.13	12.55	10.2	7.73	5.77	4.88	5.27	6.85	9.19	11.67	13.62	14.52	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	158.1	159.74	155.6	146.8	135.69	125.25	118.27	116.63	120.77	129.57	140.68	151.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	(71)

Water heating gains (Table 5)

(72)m=	106.44	104.65	100.94	95.91	92.63	88.03	84.11	89.13	90.91	96.13	102.02	104.66	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	331.86	330.14	319.95	303.64	287.3	271.36	260.86	265.81	274.07	290.57	309.52	323.5	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	2.02	x	10.63	x	0.63	x	0.7	=	6.56	(74)
North	0.9x	0.77	x	2.02	x	10.63	x	0.63	x	0.7	=	6.56	(74)
North	0.9x	0.77	x	2.02	x	10.63	x	0.63	x	0.7	=	6.56	(74)
North	0.9x	0.77	x	2.02	x	10.63	x	0.63	x	0.7	=	6.56	(74)
North	0.9x	0.77	x	2.02	x	20.32	x	0.63	x	0.7	=	12.54	(74)
North	0.9x	0.77	x	2.02	x	20.32	x	0.63	x	0.7	=	12.54	(74)
North	0.9x	0.77	x	2.02	x	20.32	x	0.63	x	0.7	=	12.54	(74)
North	0.9x	0.77	x	2.02	x	20.32	x	0.63	x	0.7	=	12.54	(74)
North	0.9x	0.77	x	2.02	x	34.53	x	0.63	x	0.7	=	21.32	(74)
North	0.9x	0.77	x	2.02	x	34.53	x	0.63	x	0.7	=	21.32	(74)
North	0.9x	0.77	x	2.02	x	34.53	x	0.63	x	0.7	=	21.32	(74)
North	0.9x	0.77	x	2.02	x	34.53	x	0.63	x	0.7	=	21.32	(74)
North	0.9x	0.77	x	2.02	x	55.46	x	0.63	x	0.7	=	34.24	(74)
North	0.9x	0.77	x	2.02	x	55.46	x	0.63	x	0.7	=	34.24	(74)
North	0.9x	0.77	x	2.02	x	55.46	x	0.63	x	0.7	=	34.24	(74)
North	0.9x	0.77	x	2.02	x	55.46	x	0.63	x	0.7	=	34.24	(74)
North	0.9x	0.77	x	2.02	x	74.72	x	0.63	x	0.7	=	46.12	(74)
North	0.9x	0.77	x	2.02	x	74.72	x	0.63	x	0.7	=	46.12	(74)
North	0.9x	0.77	x	2.02	x	74.72	x	0.63	x	0.7	=	46.12	(74)
North	0.9x	0.77	x	2.02	x	74.72	x	0.63	x	0.7	=	46.12	(74)
North	0.9x	0.77	x	2.02	x	79.99	x	0.63	x	0.7	=	49.38	(74)
North	0.9x	0.77	x	2.02	x	79.99	x	0.63	x	0.7	=	49.38	(74)
North	0.9x	0.77	x	2.02	x	79.99	x	0.63	x	0.7	=	49.38	(74)
North	0.9x	0.77	x	2.02	x	79.99	x	0.63	x	0.7	=	49.38	(74)
North	0.9x	0.77	x	2.02	x	74.68	x	0.63	x	0.7	=	46.1	(74)
North	0.9x	0.77	x	2.02	x	74.68	x	0.63	x	0.7	=	46.1	(74)
North	0.9x	0.77	x	2.02	x	74.68	x	0.63	x	0.7	=	46.1	(74)
North	0.9x	0.77	x	2.02	x	74.68	x	0.63	x	0.7	=	46.1	(74)
North	0.9x	0.77	x	2.02	x	59.25	x	0.63	x	0.7	=	36.58	(74)
North	0.9x	0.77	x	2.02	x	59.25	x	0.63	x	0.7	=	36.58	(74)
North	0.9x	0.77	x	2.02	x	59.25	x	0.63	x	0.7	=	36.58	(74)
North	0.9x	0.77	x	2.02	x	59.25	x	0.63	x	0.7	=	36.58	(74)
North	0.9x	0.77	x	2.02	x	41.52	x	0.63	x	0.7	=	25.63	(74)
North	0.9x	0.77	x	2.02	x	41.52	x	0.63	x	0.7	=	25.63	(74)
North	0.9x	0.77	x	2.02	x	41.52	x	0.63	x	0.7	=	25.63	(74)
North	0.9x	0.77	x	2.02	x	41.52	x	0.63	x	0.7	=	25.63	(74)
North	0.9x	0.77	x	2.02	x	24.19	x	0.63	x	0.7	=	14.93	(74)
North	0.9x	0.77	x	2.02	x	24.19	x	0.63	x	0.7	=	14.93	(74)
North	0.9x	0.77	x	2.02	x	24.19	x	0.63	x	0.7	=	14.93	(74)
North	0.9x	0.77	x	2.02	x	24.19	x	0.63	x	0.7	=	14.93	(74)
North	0.9x	0.77	x	2.02	x	13.12	x	0.63	x	0.7	=	8.1	(74)

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North	0.9x	0.77	x	2.02	x	13.12	x	0.63	x	0.7	=	8.1	(74)
North	0.9x	0.77	x	2.02	x	13.12	x	0.63	x	0.7	=	8.1	(74)
North	0.9x	0.77	x	2.02	x	13.12	x	0.63	x	0.7	=	8.1	(74)
North	0.9x	0.77	x	2.02	x	8.86	x	0.63	x	0.7	=	5.47	(74)
North	0.9x	0.77	x	2.02	x	8.86	x	0.63	x	0.7	=	5.47	(74)
North	0.9x	0.77	x	2.02	x	8.86	x	0.63	x	0.7	=	5.47	(74)
North	0.9x	0.77	x	2.02	x	8.86	x	0.63	x	0.7	=	5.47	(74)
East	0.9x	1	x	3.37	x	19.64	x	0.63	x	0.7	=	20.23	(76)
East	0.9x	1	x	3.37	x	38.42	x	0.63	x	0.7	=	39.57	(76)
East	0.9x	1	x	3.37	x	63.27	x	0.63	x	0.7	=	65.17	(76)
East	0.9x	1	x	3.37	x	92.28	x	0.63	x	0.7	=	95.04	(76)
East	0.9x	1	x	3.37	x	113.09	x	0.63	x	0.7	=	116.48	(76)
East	0.9x	1	x	3.37	x	115.77	x	0.63	x	0.7	=	119.23	(76)
East	0.9x	1	x	3.37	x	110.22	x	0.63	x	0.7	=	113.52	(76)
East	0.9x	1	x	3.37	x	94.68	x	0.63	x	0.7	=	97.51	(76)
East	0.9x	1	x	3.37	x	73.59	x	0.63	x	0.7	=	75.79	(76)
East	0.9x	1	x	3.37	x	45.59	x	0.63	x	0.7	=	46.95	(76)
East	0.9x	1	x	3.37	x	24.49	x	0.63	x	0.7	=	25.22	(76)
East	0.9x	1	x	3.37	x	16.15	x	0.63	x	0.7	=	16.63	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	46.49	89.75	150.43	232	300.98	316.75	297.92	243.81	178.31	106.69	57.61	38.52	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	378.35	419.89	470.39	535.64	588.28	588.1	558.78	509.62	452.38	397.25	367.13	362.03	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.96	0.88	0.73	0.57	0.63	0.87	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.49	19.63	19.92	20.32	20.68	20.9	20.97	20.96	20.78	20.33	19.84	19.46	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.74	19.74	19.74	19.76	19.76	19.77	19.77	19.77	19.76	19.76	19.75	19.75	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.98	0.94	0.83	0.62	0.42	0.49	0.79	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.76	17.97	18.39	18.96	19.45	19.7	19.76	19.75	19.59	18.99	18.29	17.73	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.62	18.8	19.15	19.64	20.06	20.3	20.37	20.36	20.18	19.66	19.06	18.6	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.62	18.8	19.15	19.64	20.06	20.3	20.37	20.36	20.18	19.66	19.06	18.6	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.99	0.98	0.94	0.84	0.67	0.5	0.56	0.82	0.96	0.99	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	375.73	415.12	459.22	502.24	495.58	394.22	277.14	285.81	370.88	380.64	362.69	359.94		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	1110.13	1075.42	976.64	821.18	638.33	431.71	285	298.9	461.92	691.19	916.41	1106.8		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	546.39	443.72	384.96	229.63	106.21	0	0	0	0	231.05	398.68	555.66		
Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =													2896.31	(98)
Space heating requirement in kWh/m²/year													53.45	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	546.39	443.72	384.96	229.63	106.21	0	0	0	0	231.05	398.68	555.66		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	584.38	474.57	411.73	245.59	113.59	0	0	0	0	247.11	426.39	594.29		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3097.66	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	172.65	152.33	160.36	144.27	141.76	127.21	122.69	133.92	133.46	149.58	157.51	168.67		
Efficiency of water heater													79.8	(216)
(217)m=	87.68	87.5	87.07	86.05	84.06	79.8	79.8	79.8	79.8	85.97	87.19	87.76		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	196.91	174.09	184.18	167.67	168.65	159.42	153.75	167.82	167.24	173.99	180.65	192.2		
Total = Sum(219a)$_{1...12}$ =													2086.56	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3097.66

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Water heating fuel used			2086.56	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			249.49	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	669.09	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	450.7	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1119.79	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	129.49	(268)
Total CO2, kg/year		sum of (265)…(271) =		1288.2	(272)
TER =				23.77	(273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-10-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	88.34	(1a) x	2.4	(2a) =	212.02	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	88.34	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		212.02	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.82	x1/[1/(1.2)+ 0.04]		=	3.23			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 5			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 6			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 7			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	69.04	20.99	48.05	x	0.18	=	8.65			(29)
Walls Type2	36.6	2.1	34.5	x	0.18	=	6.21			(29)
Roof	88.34	0	88.34	x	0.11	=	9.72			(30)
Total area of elements, m²			193.98							(31)
Party wall			21.68	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	51.13	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	21.1	(36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 72.23 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.98	34.98	34.98	34.98	34.98	34.98	34.98	34.98	34.98	34.98	34.98	34.98	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	107.22	107.22	107.22	107.22	107.22	107.22	107.22	107.22	107.22	107.22	107.22	107.22	

Average = Sum(39)$_{1…12}$ /12= 107.22 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	

Average = Sum(40)$_{1…12}$ /12= 1.21 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.6 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	105.61	101.77	97.92	94.08	90.24	86.4	86.4	90.24	94.08	97.92	101.77	105.61	

Total = Sum(44)$_{1…12}$ = 1152.06 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	156.61	136.97	141.34	123.23	118.24	102.03	94.55	108.49	109.79	127.95	139.67	151.67	

Total = Sum(45)$_{1…12}$ = 1510.53 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.49	20.55	21.2	18.48	17.74	15.3	14.18	16.27	16.47	19.19	20.95	22.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.89	186.9	196.62	176.72	173.52	155.52	149.82	163.77	163.28	183.23	193.16	206.94	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.89	186.9	196.62	176.72	173.52	155.52	149.82	163.77	163.28	183.23	193.16	206.94	

Output from water heater (annual)$_{1...12}$ 2161.37 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	96.29	85.49	91.22	83.77	83.54	76.72	75.66	80.3	79.3	86.76	89.23	94.65	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.04	18.69	15.2	11.5	8.6	7.26	7.85	10.2	13.69	17.38	20.28	21.62	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	235.99	238.44	232.27	219.13	202.55	186.96	176.55	174.1	180.27	193.41	209.99	225.58	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	(71)

Water heating gains (Table 5)

(72)m=	129.43	127.21	122.6	116.34	112.28	106.56	101.69	107.92	110.14	116.62	123.94	127.22	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	448.49	446.37	432.1	409.01	385.46	362.81	348.12	354.26	366.13	389.44	416.25	436.46	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	5.29	x	46.75	x	0.5	x	0.8	=	68.56	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	5.29	x	76.57	x	0.5	x	0.8	=	112.28	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	5.29	x	97.53	x	0.5	x	0.8	=	143.02	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	5.29	x	110.23	x	0.5	x	0.8	=	161.65	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	5.29	x	114.87	x	0.5	x	0.8	=	168.45	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	5.29	x	110.55	x	0.5	x	0.8	=	162.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	5.29	x	108.01	x	0.5	x	0.8	=	158.39	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	5.29	x	104.89	x	0.5	x	0.8	=	153.82	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	5.29	x	101.89	x	0.5	x	0.8	=	149.4	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	5.29	x	82.59	x	0.5	x	0.8	=	121.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	5.29	x	55.42	x	0.5	x	0.8	=	81.26	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
South	0.9x	0.77	x	5.29	x	40.4	x	0.5	x	0.8	=	59.24	(78)
West	0.9x	0.77	x	2.82	x	19.64	x	0.5	x	0.8	=	15.35	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.82	x	38.42	x	0.5	x	0.8	=	30.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.82	x	63.27	x	0.5	x	0.8	=	49.46	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.82	x	92.28	x	0.5	x	0.8	=	72.14	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.82	x	113.09	x	0.5	x	0.8	=	88.41	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.82	x	115.77	x	0.5	x	0.8	=	90.5	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.82	x	110.22	x	0.5	x	0.8	=	86.16	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.82	x	94.68	x	0.5	x	0.8	=	74.01	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.82	x	73.59	x	0.5	x	0.8	=	57.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.82	x	45.59	x	0.5	x	0.8	=	35.64	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)

West	0.9x	0.77	x	2.82	x	24.49	x	0.5	x	0.8	=	19.14	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.82	x	16.15	x	0.5	x	0.8	=	12.63	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	188.6	328.13	462.08	586.15	662.9	659.28	635.25	578.88	505.75	366.68	227.28	160.45	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	637.09	774.5	894.18	995.16	1048.36	1022.1	983.37	933.14	871.88	756.12	643.52	596.9	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.92	0.81	0.64	0.47	0.52	0.75	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.78	19.99	20.28	20.6	20.84	20.96	20.99	20.99	20.91	20.58	20.1	19.73	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.91	19.91	19.91	19.91	19.91	19.91	19.91	19.91	19.91	19.91	19.91	19.91	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.89	0.75	0.54	0.36	0.4	0.67	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.31	18.61	19.02	19.46	19.76	19.89	19.91	19.9	19.85	19.44	18.77	18.23	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.9	19.16	19.52	19.91	20.19	20.32	20.34	20.34	20.27	19.9	19.3	18.83	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.9	19.16	19.52	19.91	20.19	20.32	20.34	20.34	20.27	19.9	19.3	18.83	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.89	0.77	0.58	0.4	0.45	0.7	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	632.08	759.75	853.49	886.15	802.04	590.78	397.9	417.11	608.88	695.78	632.62	593.36	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1565.21	1528.85	1395.99	1180.67	910.66	612.81	401.08	422.24	661.83	996.89	1308.51	1568.75	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	694.25	516.83	403.62	212.05	80.82	0	0	0	0	224.03	486.64	725.69	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 3343.94 (98)

Space heating requirement in kWh/m²/year 37.85 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.			
Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		3343.94	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	3511.14	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2161.37	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2269.44	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	57.81	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		57.16	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	57.16	(331)
Energy for lighting (calculated in Appendix L)		371.55	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1342.59	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	30	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1372.59	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1372.59	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	29.67	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	192.83	(379)
Total CO2, kg/year	sum of (376)…(382) =			1595.09	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.06	(384)
EI rating (section 14)				83.97	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-10-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	88.34	(1a) x	2.4	(2a) =	212.02	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	88.34	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	212.02	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30 ÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.39	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.63	x1/[1/(1.4)+ 0.04]		=	3.49			(27)
Windows Type 2			2.68	x1/[1/(1.4)+ 0.04]		=	3.55			(27)
Windows Type 3			2.63	x1/[1/(1.4)+ 0.04]		=	3.49			(27)
Windows Type 4			1.75	x1/[1/(1.4)+ 0.04]		=	2.32			(27)
Windows Type 5			5.04	x1/[1/(1.4)+ 0.04]		=	6.68			(27)
Windows Type 6			2.63	x1/[1/(1.4)+ 0.04]		=	3.49			(27)
Windows Type 7			2.63	x1/[1/(1.4)+ 0.04]		=	3.49			(27)
Walls Type1	69.04	19.99	49.05	x	0.18	=	8.83			(29)
Walls Type2	36.6	2.1	34.5	x	0.18	=	6.21			(29)
Roof	88.34	0	88.34	x	0.13	=	11.48			(30)
Total area of elements, m²			193.98							(31)
Party wall			21.68	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	55.13	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	24.62	(36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 79.75 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.28	41.04	40.8	39.67	39.46	38.48	38.48	38.3	38.86	39.46	39.89	40.33	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	121.03	120.79	120.55	119.42	119.21	118.23	118.23	118.05	118.61	119.21	119.64	120.08	

Average = Sum(39)$_{1...12}$ /12= 119.42 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.37	1.37	1.36	1.35	1.35	1.34	1.34	1.34	1.34	1.35	1.35	1.36	

Average = Sum(40)$_{1...12}$ /12= 1.35 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.6 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	105.61	101.77	97.92	94.08	90.24	86.4	86.4	90.24	94.08	97.92	101.77	105.61	

Total = Sum(44)$_{1...12}$ = 1152.06 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	156.61	136.97	141.34	123.23	118.24	102.03	94.55	108.49	109.79	127.95	139.67	151.67	

Total = Sum(45)$_{1...12}$ = 1510.53 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.49	20.55	21.2	18.48	17.74	15.3	14.18	16.27	16.47	19.19	20.95	22.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	203.2	179.06	187.94	168.32	164.83	147.12	141.14	155.09	154.88	174.54	184.76	198.26	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	203.2	179.06	187.94	168.32	164.83	147.12	141.14	155.09	154.88	174.54	184.76	198.26

Output from water heater (annual)$_{1…12}$ | 2059.15 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.35	79.21	84.27	77.05	76.59	70	68.71	73.35	72.58	79.82	82.51	87.71	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.03	18.68	15.19	11.5	8.6	7.26	7.84	10.2	13.68	17.38	20.28	21.62	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	235.99	238.44	232.27	219.13	202.55	186.96	176.55	174.1	180.27	193.41	209.99	225.58	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	(71)

Water heating gains (Table 5)

(72)m=	120.09	117.87	113.27	107.01	102.94	97.22	92.36	98.59	100.8	107.28	114.6	117.88	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	442.15	440.03	425.77	402.68	379.12	356.48	341.78	347.92	359.79	383.1	409.91	430.12	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.63	x	19.64	x	0.63	x	0.7	=	15.79	(76)
East	0.9x	1	x	2.63	x	19.64	x	0.63	x	0.7	=	15.79	(76)
East	0.9x	1	x	2.63	x	38.42	x	0.63	x	0.7	=	30.88	(76)
East	0.9x	1	x	2.63	x	38.42	x	0.63	x	0.7	=	30.88	(76)
East	0.9x	1	x	2.63	x	63.27	x	0.63	x	0.7	=	50.86	(76)
East	0.9x	1	x	2.63	x	63.27	x	0.63	x	0.7	=	50.86	(76)
East	0.9x	1	x	2.63	x	92.28	x	0.63	x	0.7	=	74.17	(76)
East	0.9x	1	x	2.63	x	92.28	x	0.63	x	0.7	=	74.17	(76)
East	0.9x	1	x	2.63	x	113.09	x	0.63	x	0.7	=	90.9	(76)
East	0.9x	1	x	2.63	x	113.09	x	0.63	x	0.7	=	90.9	(76)
East	0.9x	1	x	2.63	x	115.77	x	0.63	x	0.7	=	93.05	(76)
East	0.9x	1	x	2.63	x	115.77	x	0.63	x	0.7	=	93.05	(76)
East	0.9x	1	x	2.63	x	110.22	x	0.63	x	0.7	=	88.59	(76)
East	0.9x	1	x	2.63	x	110.22	x	0.63	x	0.7	=	88.59	(76)
East	0.9x	1	x	2.63	x	94.68	x	0.63	x	0.7	=	76.1	(76)
East	0.9x	1	x	2.63	x	94.68	x	0.63	x	0.7	=	76.1	(76)
East	0.9x	1	x	2.63	x	73.59	x	0.63	x	0.7	=	59.15	(76)
East	0.9x	1	x	2.63	x	73.59	x	0.63	x	0.7	=	59.15	(76)
East	0.9x	1	x	2.63	x	45.59	x	0.63	x	0.7	=	36.64	(76)
East	0.9x	1	x	2.63	x	45.59	x	0.63	x	0.7	=	36.64	(76)
East	0.9x	1	x	2.63	x	24.49	x	0.63	x	0.7	=	19.68	(76)
East	0.9x	1	x	2.63	x	24.49	x	0.63	x	0.7	=	19.68	(76)
East	0.9x	1	x	2.63	x	16.15	x	0.63	x	0.7	=	12.98	(76)
East	0.9x	1	x	2.63	x	16.15	x	0.63	x	0.7	=	12.98	(76)
South	0.9x	0.77	x	2.63	x	46.75	x	0.63	x	0.7	=	37.58	(78)
South	0.9x	0.77	x	1.75	x	46.75	x	0.63	x	0.7	=	25	(78)
South	0.9x	0.77	x	5.04	x	46.75	x	0.63	x	0.7	=	72.01	(78)
South	0.9x	0.77	x	2.63	x	76.57	x	0.63	x	0.7	=	61.54	(78)
South	0.9x	0.77	x	1.75	x	76.57	x	0.63	x	0.7	=	40.95	(78)
South	0.9x	0.77	x	5.04	x	76.57	x	0.63	x	0.7	=	117.94	(78)
South	0.9x	0.77	x	2.63	x	97.53	x	0.63	x	0.7	=	78.39	(78)
South	0.9x	0.77	x	1.75	x	97.53	x	0.63	x	0.7	=	52.16	(78)
South	0.9x	0.77	x	5.04	x	97.53	x	0.63	x	0.7	=	150.23	(78)
South	0.9x	0.77	x	2.63	x	110.23	x	0.63	x	0.7	=	88.6	(78)
South	0.9x	0.77	x	1.75	x	110.23	x	0.63	x	0.7	=	58.96	(78)
South	0.9x	0.77	x	5.04	x	110.23	x	0.63	x	0.7	=	169.79	(78)
South	0.9x	0.77	x	2.63	x	114.87	x	0.63	x	0.7	=	92.33	(78)
South	0.9x	0.77	x	1.75	x	114.87	x	0.63	x	0.7	=	61.44	(78)
South	0.9x	0.77	x	5.04	x	114.87	x	0.63	x	0.7	=	176.93	(78)

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South	0.9x	0.77	x	2.63	x	110.55	x	0.63	x	0.7	=	88.85	(78)
South	0.9x	0.77	x	1.75	x	110.55	x	0.63	x	0.7	=	59.12	(78)
South	0.9x	0.77	x	5.04	x	110.55	x	0.63	x	0.7	=	170.28	(78)
South	0.9x	0.77	x	2.63	x	108.01	x	0.63	x	0.7	=	86.82	(78)
South	0.9x	0.77	x	1.75	x	108.01	x	0.63	x	0.7	=	57.77	(78)
South	0.9x	0.77	x	5.04	x	108.01	x	0.63	x	0.7	=	166.37	(78)
South	0.9x	0.77	x	2.63	x	104.89	x	0.63	x	0.7	=	84.31	(78)
South	0.9x	0.77	x	1.75	x	104.89	x	0.63	x	0.7	=	56.1	(78)
South	0.9x	0.77	x	5.04	x	104.89	x	0.63	x	0.7	=	161.57	(78)
South	0.9x	0.77	x	2.63	x	101.89	x	0.63	x	0.7	=	81.89	(78)
South	0.9x	0.77	x	1.75	x	101.89	x	0.63	x	0.7	=	54.49	(78)
South	0.9x	0.77	x	5.04	x	101.89	x	0.63	x	0.7	=	156.93	(78)
South	0.9x	0.77	x	2.63	x	82.59	x	0.63	x	0.7	=	66.38	(78)
South	0.9x	0.77	x	1.75	x	82.59	x	0.63	x	0.7	=	44.17	(78)
South	0.9x	0.77	x	5.04	x	82.59	x	0.63	x	0.7	=	127.21	(78)
South	0.9x	0.77	x	2.63	x	55.42	x	0.63	x	0.7	=	44.54	(78)
South	0.9x	0.77	x	1.75	x	55.42	x	0.63	x	0.7	=	29.64	(78)
South	0.9x	0.77	x	5.04	x	55.42	x	0.63	x	0.7	=	85.36	(78)
South	0.9x	0.77	x	2.63	x	40.4	x	0.63	x	0.7	=	32.47	(78)
South	0.9x	0.77	x	1.75	x	40.4	x	0.63	x	0.7	=	21.61	(78)
South	0.9x	0.77	x	5.04	x	40.4	x	0.63	x	0.7	=	62.22	(78)
West	0.9x	0.77	x	2.68	x	19.64	x	0.63	x	0.7	=	16.09	(80)
West	0.9x	0.77	x	2.63	x	19.64	x	0.63	x	0.7	=	15.79	(80)
West	0.9x	0.77	x	2.68	x	38.42	x	0.63	x	0.7	=	31.47	(80)
West	0.9x	0.77	x	2.63	x	38.42	x	0.63	x	0.7	=	30.88	(80)
West	0.9x	0.77	x	2.68	x	63.27	x	0.63	x	0.7	=	51.82	(80)
West	0.9x	0.77	x	2.63	x	63.27	x	0.63	x	0.7	=	50.86	(80)
West	0.9x	0.77	x	2.68	x	92.28	x	0.63	x	0.7	=	75.58	(80)
West	0.9x	0.77	x	2.63	x	92.28	x	0.63	x	0.7	=	74.17	(80)
West	0.9x	0.77	x	2.68	x	113.09	x	0.63	x	0.7	=	92.63	(80)
West	0.9x	0.77	x	2.63	x	113.09	x	0.63	x	0.7	=	90.9	(80)
West	0.9x	0.77	x	2.68	x	115.77	x	0.63	x	0.7	=	94.82	(80)
West	0.9x	0.77	x	2.63	x	115.77	x	0.63	x	0.7	=	93.05	(80)
West	0.9x	0.77	x	2.68	x	110.22	x	0.63	x	0.7	=	90.27	(80)
West	0.9x	0.77	x	2.63	x	110.22	x	0.63	x	0.7	=	88.59	(80)
West	0.9x	0.77	x	2.68	x	94.68	x	0.63	x	0.7	=	77.54	(80)
West	0.9x	0.77	x	2.63	x	94.68	x	0.63	x	0.7	=	76.1	(80)
West	0.9x	0.77	x	2.68	x	73.59	x	0.63	x	0.7	=	60.27	(80)
West	0.9x	0.77	x	2.63	x	73.59	x	0.63	x	0.7	=	59.15	(80)
West	0.9x	0.77	x	2.68	x	45.59	x	0.63	x	0.7	=	37.34	(80)
West	0.9x	0.77	x	2.63	x	45.59	x	0.63	x	0.7	=	36.64	(80)

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West	0.9x	0.77	x	2.68	x	24.49	x	0.63	x	0.7	=	20.06	(80)
West	0.9x	0.77	x	2.63	x	24.49	x	0.63	x	0.7	=	19.68	(80)
West	0.9x	0.77	x	2.68	x	16.15	x	0.63	x	0.7	=	13.23	(80)
West	0.9x	0.77	x	2.63	x	16.15	x	0.63	x	0.7	=	12.98	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	198.04	344.54	485.18	615.45	696.03	692.23	666.99	607.81	531.03	385.02	238.65	168.47	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	640.19	784.57	910.95	1018.12	1075.15	1048.71	1008.78	955.73	890.83	768.12	648.55	598.59	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.93	0.83	0.67	0.5	0.55	0.78	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.59	19.8	20.12	20.49	20.78	20.94	20.99	20.98	20.87	20.48	19.95	19.55	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.79	19.79	19.79	19.8	19.8	19.81	19.81	19.81	19.81	19.8	19.8	19.79	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.9	0.77	0.56	0.37	0.42	0.69	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.93	18.25	18.7	19.22	19.59	19.77	19.81	19.81	19.71	19.22	18.48	17.88	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.59	18.87	19.27	19.73	20.07	20.24	20.28	20.27	20.18	19.73	19.07	18.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.59	18.87	19.27	19.73	20.07	20.24	20.28	20.27	20.18	19.73	19.07	18.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.9	0.78	0.6	0.43	0.47	0.72	0.93	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	634.98	769.75	871.49	914.65	842.93	631.57	429.01	448.38	642.53	711.23	637.69	594.87	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1730.01	1687.78	1539.23	1293	997.44	666.77	434.88	457.43	720.91	1087.89	1431.87	1722.67	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	814.7	616.92	496.8	272.41	114.95	0	0	0	0	280.23	571.82	839.08	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 4006.91 (98)

Space heating requirement in kWh/m²/year 45.36 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	814.7	616.92	496.8	272.41	114.95	0	0	0	0	280.23	571.82	839.08		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	871.34	659.81	531.33	291.35	122.94	0	0	0	0	299.71	611.57	897.41		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													4285.46	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	203.2	179.06	187.94	168.32	164.83	147.12	141.14	155.09	154.88	174.54	184.76	198.26		
Efficiency of water heater													79.8	(216)
(217)m=	88.14	87.85	87.29	86.09	83.87	79.8	79.8	79.8	79.8	86.07	87.63	88.24		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	230.55	203.82	215.31	195.51	196.52	184.36	176.87	194.35	194.09	202.79	210.84	224.69		
Total = Sum(219a)$_{1...12}$ =													2429.69	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			4285.46	
Water heating fuel used			2429.69	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			371.48	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	925.66	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	524.81	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1450.47	(265)

TER WorkSheet: New dwelling design stage

Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	192.8	(268)
Total CO2, kg/year			sum of (265)…(271) =		1682.2	(272)

TER = 19.04 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-10-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	74.36	(1a)	x	2.4	(2a)	=	178.46	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.36	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			178.46	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			5.48	x1/[1/(1.2)+ 0.04]		=	6.27			(27)
Windows Type 5			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 6			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	39.66	18.36	21.3	x	0.18	=	3.83			(29)
Walls Type2	16.48	2.1	14.38	x	0.18	=	2.59			(29)
Roof	74.36	0	74.36	x	0.11	=	8.18			(30)
Total area of elements, m²			130.5							(31)
Party wall			37.04	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.14 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 17.22 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 55.37 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.45	29.45	29.45	29.45	29.45	29.45	29.45	29.45	29.45	29.45	29.45	29.45	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	84.81	84.81	84.81	84.81	84.81	84.81	84.81	84.81	84.81	84.81	84.81	84.81

Average = Sum(39)$_{1…12}$ /12= 84.81 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14

Average = Sum(40)$_{1…12}$ /12= 1.14 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.95 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	98.94	95.34	91.74	88.15	84.55	80.95	80.95	84.55	88.15	91.74	95.34	98.94

Total = Sum(44)$_{1…12}$ = 1079.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.72	128.33	132.42	115.45	110.78	95.59	88.58	101.65	102.86	119.87	130.85	142.09

Total = Sum(45)$_{1…12}$ = 1415.19 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.01	19.25	19.86	17.32	16.62	14.34	13.29	15.25	15.43	17.98	19.63	21.31	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202	178.25	187.7	168.94	166.05	149.08	143.86	156.92	156.35	175.15	184.34	197.37	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202	178.25	187.7	168.94	166.05	149.08	143.86	156.92	156.35	175.15	184.34	197.37	

Output from water heater (annual)$_{1...12}$ — 2066.03 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.01	82.61	88.25	81.18	81.05	74.58	73.67	78.02	77	84.08	86.3	91.47	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.48	16.41	13.35	10.1	7.55	6.38	6.89	8.96	12.02	15.26	17.81	18.99	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	207.25	209.4	203.98	192.45	177.88	164.19	155.05	152.9	158.32	169.86	184.42	198.11	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	(71)

Water heating gains (Table 5)

(72)m=	125.01	122.93	118.62	112.75	108.94	103.58	99.02	104.86	106.94	113.01	119.86	122.94	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	408.95	406.95	394.15	373.51	352.59	332.36	319.17	324.93	335.48	356.34	380.31	398.25	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.48	x	10.63	x	0.5	x	0.8	=	16.15	(74)
North	0.9x	0.77	x	5.48	x	20.32	x	0.5	x	0.8	=	30.87	(74)
North	0.9x	0.77	x	5.48	x	34.53	x	0.5	x	0.8	=	52.45	(74)
North	0.9x	0.77	x	5.48	x	55.46	x	0.5	x	0.8	=	84.25	(74)
North	0.9x	0.77	x	5.48	x	74.72	x	0.5	x	0.8	=	113.5	(74)
North	0.9x	0.77	x	5.48	x	79.99	x	0.5	x	0.8	=	121.5	(74)
North	0.9x	0.77	x	5.48	x	74.68	x	0.5	x	0.8	=	113.44	(74)
North	0.9x	0.77	x	5.48	x	59.25	x	0.5	x	0.8	=	90	(74)
North	0.9x	0.77	x	5.48	x	41.52	x	0.5	x	0.8	=	63.07	(74)
North	0.9x	0.77	x	5.48	x	24.19	x	0.5	x	0.8	=	36.75	(74)
North	0.9x	0.77	x	5.48	x	13.12	x	0.5	x	0.8	=	19.93	(74)
North	0.9x	0.77	x	5.48	x	8.86	x	0.5	x	0.8	=	13.47	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.28	168.04	278.36	413.72	517.28	534.84	506.95	428.02	325.8	199.51	107.36	71.13	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	495.22	575	672.51	787.23	869.86	867.2	826.12	752.95	661.29	555.85	487.67	469.38	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	1	0.99	0.98	0.92	0.79	0.6	0.45	0.51	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.83	19.99	20.28	20.62	20.87	20.97	21	20.99	20.91	20.56	20.12	19.79	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.73	0.52	0.34	0.4	0.7	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.42	18.65	19.06	19.54	19.85	19.95	19.97	19.96	19.9	19.47	18.84	18.36	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.98	19.19	19.55	19.97	20.26	20.36	20.38	20.38	20.31	19.91	19.35	18.93	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.98	19.19	19.55	19.97	20.26	20.36	20.38	20.38	20.31	19.91	19.35	18.93	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.9	0.75	0.55	0.39	0.44	0.73	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	492.4	567.97	650.18	707.8	653.73	476.53	318.78	333.93	481.16	524.16	481.98	467.3	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1245.44	1212.04	1106.55	939.1	726.03	488.61	320.41	337.15	526.35	789.2	1039.2	1249.29	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	560.26	432.82	339.54	166.54	53.78	0	0	0	0	197.19	401.2	581.8	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2733.13 (98)

Space heating requirement in kWh/m²/year 36.76 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating **kWh/year**

Annual space heating requirement 2733.13

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Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2869.79	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2066.03	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2169.33	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	50.39	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		48.12	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	48.12	(331)
Energy for lighting (calculated in Appendix L)		326.3	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1170.38	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	26.15	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1196.53	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1196.53	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	24.97	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	169.35	(379)

Total CO2, kg/year	sum of (376)…(382) =	1390.85	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =	18.7	(384)
EI rating (section 14)		84.39	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-10-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.36	(1a) x	2.4	(2a) =	178.46	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.36	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	178.46	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.48	x1/[1/(1.4)+ 0.04]		=	3.29			(27)
Windows Type 2			2.48	x1/[1/(1.4)+ 0.04]		=	3.29			(27)
Windows Type 3			2.48	x1/[1/(1.4)+ 0.04]		=	3.29			(27)
Windows Type 4			4.92	x1/[1/(1.4)+ 0.04]		=	6.52			(27)
Windows Type 5			1.65	x1/[1/(1.4)+ 0.04]		=	2.19			(27)
Windows Type 6			2.48	x1/[1/(1.4)+ 0.04]		=	3.29			(27)
Walls Type1	39.66	16.49	23.17	x	0.18	=	4.17			(29)
Walls Type2	16.48	2.1	14.38	x	0.18	=	2.59			(29)
Roof	74.36	0	74.36	x	0.13	=	9.67			(30)
Total area of elements, m²			130.5							(31)
Party wall			37.04	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	40.39	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	17.3	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

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Total fabric heat loss	(33) + (36) =	57.69	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.49	35.26	35.03	33.95	33.74	32.8	32.8	32.63	33.17	33.74	34.15	34.58	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	93.18	92.95	92.71	91.63	91.43	90.49	90.49	90.32	90.85	91.43	91.84	92.27	

Average = Sum(39)$_{1…12}$ /12= 91.63 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.25	1.25	1.25	1.23	1.23	1.22	1.22	1.21	1.22	1.23	1.24	1.24	

Average = Sum(40)$_{1…12}$ /12= 1.23 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.95 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.94	95.34	91.74	88.15	84.55	80.95	80.95	84.55	88.15	91.74	95.34	98.94	

Total = Sum(44)$_{1…12}$ = 1079.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.72	128.33	132.42	115.45	110.78	95.59	88.58	101.65	102.86	119.87	130.85	142.09	

Total = Sum(45)$_{1…12}$ = 1415.19 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.01	19.25	19.86	17.32	16.62	14.34	13.29	15.25	15.43	17.98	19.63	21.31	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		150	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)			
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)			
Water storage loss:			
a) If manufacturer's declared loss factor is known (kWh/day):		1.39	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0.75	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.75	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	193.32	170.41	179.02	160.54	157.37	140.68	135.17	148.24	147.95	166.47	175.94	188.69	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	193.32	170.41	179.02	160.54	157.37	140.68	135.17	148.24	147.95	166.47	175.94	188.69	

Output from water heater (annual)$_{1...12}$ 1963.8 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.06	76.34	81.31	74.46	74.11	67.86	66.73	71.07	70.27	77.13	79.58	84.52	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.48	16.41	13.35	10.11	7.55	6.38	6.89	8.96	12.02	15.26	17.82	18.99	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	207.25	209.4	203.98	192.45	177.88	164.19	155.05	152.9	158.32	169.86	184.42	198.11	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	(71)

Water heating gains (Table 5)

(72)m=	115.67	113.6	109.28	103.42	99.61	94.25	89.69	95.53	97.6	103.67	110.53	113.61	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	402.61	400.62	387.82	367.17	346.25	326.02	312.84	318.59	329.15	350	373.97	391.91	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.92	x	10.63	x	0.63	x	0.7	=	15.99	(74)
North	0.9x	0.77	x	4.92	x	20.32	x	0.63	x	0.7	=	30.55	(74)
North	0.9x	0.77	x	4.92	x	34.53	x	0.63	x	0.7	=	51.92	(74)
North	0.9x	0.77	x	4.92	x	55.46	x	0.63	x	0.7	=	83.4	(74)
North	0.9x	0.77	x	4.92	x	74.72	x	0.63	x	0.7	=	112.34	(74)
North	0.9x	0.77	x	4.92	x	79.99	x	0.63	x	0.7	=	120.27	(74)
North	0.9x	0.77	x	4.92	x	74.68	x	0.63	x	0.7	=	112.28	(74)
North	0.9x	0.77	x	4.92	x	59.25	x	0.63	x	0.7	=	89.08	(74)
North	0.9x	0.77	x	4.92	x	41.52	x	0.63	x	0.7	=	62.42	(74)
North	0.9x	0.77	x	4.92	x	24.19	x	0.63	x	0.7	=	36.37	(74)
North	0.9x	0.77	x	4.92	x	13.12	x	0.63	x	0.7	=	19.72	(74)
North	0.9x	0.77	x	4.92	x	8.86	x	0.63	x	0.7	=	13.33	(74)
West	0.9x	0.77	x	2.48	x	19.64	x	0.63	x	0.7	=	14.89	(80)
West	0.9x	0.77	x	2.48	x	19.64	x	0.63	x	0.7	=	14.89	(80)
West	0.9x	0.77	x	2.48	x	19.64	x	0.63	x	0.7	=	14.89	(80)
West	0.9x	0.77	x	1.65	x	19.64	x	0.63	x	0.7	=	9.9	(80)
West	0.9x	0.77	x	2.48	x	19.64	x	0.63	x	0.7	=	14.89	(80)
West	0.9x	0.77	x	2.48	x	38.42	x	0.63	x	0.7	=	29.12	(80)
West	0.9x	0.77	x	2.48	x	38.42	x	0.63	x	0.7	=	29.12	(80)
West	0.9x	0.77	x	2.48	x	38.42	x	0.63	x	0.7	=	29.12	(80)
West	0.9x	0.77	x	1.65	x	38.42	x	0.63	x	0.7	=	19.37	(80)
West	0.9x	0.77	x	2.48	x	38.42	x	0.63	x	0.7	=	29.12	(80)
West	0.9x	0.77	x	2.48	x	63.27	x	0.63	x	0.7	=	47.96	(80)
West	0.9x	0.77	x	2.48	x	63.27	x	0.63	x	0.7	=	47.96	(80)
West	0.9x	0.77	x	2.48	x	63.27	x	0.63	x	0.7	=	47.96	(80)
West	0.9x	0.77	x	1.65	x	63.27	x	0.63	x	0.7	=	31.91	(80)
West	0.9x	0.77	x	2.48	x	63.27	x	0.63	x	0.7	=	47.96	(80)
West	0.9x	0.77	x	2.48	x	92.28	x	0.63	x	0.7	=	69.94	(80)
West	0.9x	0.77	x	2.48	x	92.28	x	0.63	x	0.7	=	69.94	(80)
West	0.9x	0.77	x	2.48	x	92.28	x	0.63	x	0.7	=	69.94	(80)
West	0.9x	0.77	x	1.65	x	92.28	x	0.63	x	0.7	=	46.53	(80)
West	0.9x	0.77	x	2.48	x	92.28	x	0.63	x	0.7	=	69.94	(80)
West	0.9x	0.77	x	2.48	x	113.09	x	0.63	x	0.7	=	85.72	(80)
West	0.9x	0.77	x	2.48	x	113.09	x	0.63	x	0.7	=	85.72	(80)
West	0.9x	0.77	x	2.48	x	113.09	x	0.63	x	0.7	=	85.72	(80)
West	0.9x	0.77	x	1.65	x	113.09	x	0.63	x	0.7	=	57.03	(80)
West	0.9x	0.77	x	2.48	x	113.09	x	0.63	x	0.7	=	85.72	(80)
West	0.9x	0.77	x	2.48	x	115.77	x	0.63	x	0.7	=	87.74	(80)
West	0.9x	0.77	x	2.48	x	115.77	x	0.63	x	0.7	=	87.74	(80)

West	0.9x	0.77	x	2.48	x	115.77	x	0.63	x	0.7	=	87.74	(80)
West	0.9x	0.77	x	1.65	x	115.77	x	0.63	x	0.7	=	58.38	(80)
West	0.9x	0.77	x	2.48	x	115.77	x	0.63	x	0.7	=	87.74	(80)
West	0.9x	0.77	x	2.48	x	110.22	x	0.63	x	0.7	=	83.54	(80)
West	0.9x	0.77	x	2.48	x	110.22	x	0.63	x	0.7	=	83.54	(80)
West	0.9x	0.77	x	2.48	x	110.22	x	0.63	x	0.7	=	83.54	(80)
West	0.9x	0.77	x	1.65	x	110.22	x	0.63	x	0.7	=	55.58	(80)
West	0.9x	0.77	x	2.48	x	110.22	x	0.63	x	0.7	=	83.54	(80)
West	0.9x	0.77	x	2.48	x	94.68	x	0.63	x	0.7	=	71.76	(80)
West	0.9x	0.77	x	2.48	x	94.68	x	0.63	x	0.7	=	71.76	(80)
West	0.9x	0.77	x	2.48	x	94.68	x	0.63	x	0.7	=	71.76	(80)
West	0.9x	0.77	x	1.65	x	94.68	x	0.63	x	0.7	=	47.74	(80)
West	0.9x	0.77	x	2.48	x	94.68	x	0.63	x	0.7	=	71.76	(80)
West	0.9x	0.77	x	2.48	x	73.59	x	0.63	x	0.7	=	55.77	(80)
West	0.9x	0.77	x	2.48	x	73.59	x	0.63	x	0.7	=	55.77	(80)
West	0.9x	0.77	x	2.48	x	73.59	x	0.63	x	0.7	=	55.77	(80)
West	0.9x	0.77	x	1.65	x	73.59	x	0.63	x	0.7	=	37.11	(80)
West	0.9x	0.77	x	2.48	x	73.59	x	0.63	x	0.7	=	55.77	(80)
West	0.9x	0.77	x	2.48	x	45.59	x	0.63	x	0.7	=	34.55	(80)
West	0.9x	0.77	x	2.48	x	45.59	x	0.63	x	0.7	=	34.55	(80)
West	0.9x	0.77	x	2.48	x	45.59	x	0.63	x	0.7	=	34.55	(80)
West	0.9x	0.77	x	1.65	x	45.59	x	0.63	x	0.7	=	22.99	(80)
West	0.9x	0.77	x	2.48	x	45.59	x	0.63	x	0.7	=	34.55	(80)
West	0.9x	0.77	x	2.48	x	24.49	x	0.63	x	0.7	=	18.56	(80)
West	0.9x	0.77	x	2.48	x	24.49	x	0.63	x	0.7	=	18.56	(80)
West	0.9x	0.77	x	2.48	x	24.49	x	0.63	x	0.7	=	18.56	(80)
West	0.9x	0.77	x	1.65	x	24.49	x	0.63	x	0.7	=	12.35	(80)
West	0.9x	0.77	x	2.48	x	24.49	x	0.63	x	0.7	=	18.56	(80)
West	0.9x	0.77	x	2.48	x	16.15	x	0.63	x	0.7	=	12.24	(80)
West	0.9x	0.77	x	2.48	x	16.15	x	0.63	x	0.7	=	12.24	(80)
West	0.9x	0.77	x	2.48	x	16.15	x	0.63	x	0.7	=	12.24	(80)
West	0.9x	0.77	x	1.65	x	16.15	x	0.63	x	0.7	=	8.14	(80)
West	0.9x	0.77	x	2.48	x	16.15	x	0.63	x	0.7	=	12.24	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	85.44	166.41	275.65	409.69	512.23	529.63	502.01	423.85	322.63	197.57	106.32	70.44	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	488.05	567.03	663.47	776.87	858.48	855.65	814.85	742.44	651.78	547.57	480.29	462.35	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	1	0.99	0.98	0.94	0.82	0.64	0.48	0.54	0.81	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.67	19.84	20.14	20.53	20.82	20.96	20.99	20.99	20.88	20.48	20.01	19.65	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.88	19.88	19.88	19.89	19.9	19.91	19.91	19.91	19.9	19.9	19.89	19.89	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.77	0.55	0.37	0.42	0.73	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.12	18.37	18.8	19.35	19.73	19.88	19.9	19.9	19.81	19.3	18.62	18.09	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.74	18.96	19.34	19.82	20.17	20.31	20.34	20.34	20.24	19.77	19.17	18.71	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.74	18.96	19.34	19.82	20.17	20.31	20.34	20.34	20.24	19.77	19.17	18.71	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.78	0.58	0.41	0.47	0.76	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	485.38	560.65	644.1	708.97	670.62	497.75	335.41	350.04	493.38	520.28	475.12	460.37	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1345.93	1306.82	1190.24	1000.82	774.03	516.97	338.33	355.47	557.46	838.33	1108.89	1339.2	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	640.25	501.42	406.33	210.13	76.93	0	0	0	0	236.63	456.31	653.85	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3181.86 (98)

Space heating requirement in kWh/m²/year 42.79 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	640.25	501.42	406.33	210.13	76.93	0	0	0	0	236.63	456.31	653.85	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	684.76	536.28	434.58	224.74	82.28	0	0	0	0	253.08	488.03	699.3	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3403.06 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

193.32	170.41	179.02	160.54	157.37	140.68	135.17	148.24	147.95	166.47	175.94	188.69

Efficiency of water heater 79.8 (216)

(217)m=	87.77	87.52	86.94	85.53	83.02	79.8	79.8	79.8	79.8	85.75	87.24	87.86	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	220.26	194.7	205.92	187.69	189.55	176.29	169.39	185.76	185.4	194.13	201.67	214.76

Total = Sum(219a)$_{1...12}$ = 2325.53 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3403.06	
Water heating fuel used		2325.53	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		326.34	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	735.06	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	502.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1237.37	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	169.37	(268)
Total CO2, kg/year		sum of (265)…(271) =		1445.67	(272)

TER = 19.44 (273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-2-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.14	(1a) x	2.4	(2a) =	206.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.14	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		206.74	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 4			8.05	x1/[1/(1.2)+ 0.04]		=	9.22			(27)
Windows Type 5			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Floor			86.14	x	0.11	=	9.4754			(28)
Walls Type1	44.62	19.78	24.84	x	0.18	=	4.47			(29)
Walls Type2	5.87	2.1	3.77	x	0.18	=	0.68			(29)
Total area of elements, m²			136.63							(31)
Party wall			44.11	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.79 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.16 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 54.95 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	89.06	89.06	89.06	89.06	89.06	89.06	89.06	89.06	89.06	89.06	89.06	89.06	

Average = Sum(39)$_{1...12}$ /12= 89.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	

Average = Sum(40)$_{1...12}$ /12= 1.03 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	104.74	100.93	97.12	93.31	89.5	85.69	85.69	89.5	93.31	97.12	100.93	104.74	

Total = Sum(44)$_{1...12}$ = 1142.6 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.32	135.85	140.18	122.21	117.27	101.19	93.77	107.6	108.89	126.9	138.52	150.42	

Total = Sum(45)$_{1...12}$ = 1498.13 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.3	20.38	21.03	18.33	17.59	15.18	14.07	16.14	16.33	19.03	20.78	22.56	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.6	185.77	195.46	175.71	172.54	154.69	149.05	162.88	162.38	182.17	192.01	205.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	210.6	185.77	195.46	175.71	172.54	154.69	149.05	162.88	162.38	182.17	192.01	205.7

Output from water heater (annual)$_{1…12}$ — 2148.97 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	95.87	85.11	90.83	83.43	83.21	76.44	75.4	80	79	86.42	88.85	94.24	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.66	18.35	14.93	11.3	8.45	7.13	7.71	10.02	13.44	17.07	19.92	21.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	231.79	234.2	228.14	215.23	198.95	183.64	173.41	171	177.07	189.97	206.26	221.57	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	(71)

Water heating gains (Table 5)

(72)m=	128.85	126.65	122.09	115.88	111.85	106.17	101.34	107.53	109.72	116.15	123.41	126.66	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	442.85	440.74	426.69	403.95	380.78	358.47	344	350.08	361.77	384.73	411.12	431.01	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)

North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
East	0.9x	1	x	8.05	x	19.64	x	0.5	x	0.8	=	43.83	(76)
East	0.9x	1	x	8.05	x	38.42	x	0.5	x	0.8	=	85.73	(76)
East	0.9x	1	x	8.05	x	63.27	x	0.5	x	0.8	=	141.19	(76)
East	0.9x	1	x	8.05	x	92.28	x	0.5	x	0.8	=	205.92	(76)
East	0.9x	1	x	8.05	x	113.09	x	0.5	x	0.8	=	252.36	(76)
East	0.9x	1	x	8.05	x	115.77	x	0.5	x	0.8	=	258.34	(76)
East	0.9x	1	x	8.05	x	110.22	x	0.5	x	0.8	=	245.95	(76)
East	0.9x	1	x	8.05	x	94.68	x	0.5	x	0.8	=	211.27	(76)
East	0.9x	1	x	8.05	x	73.59	x	0.5	x	0.8	=	164.21	(76)
East	0.9x	1	x	8.05	x	45.59	x	0.5	x	0.8	=	101.73	(76)
East	0.9x	1	x	8.05	x	24.49	x	0.5	x	0.8	=	54.65	(76)
East	0.9x	1	x	8.05	x	16.15	x	0.5	x	0.8	=	36.04	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	78.4	151.81	253.47	386.27	495.3	518.41	488.76	403.91	299.2	180.38	97.3	64.86	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.25	592.55	680.16	790.21	876.08	876.89	832.76	753.99	660.97	565.11	508.42	495.87	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.94	0.82	0.63	0.47	0.53	0.81	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.92	20.06	20.31	20.63	20.88	20.98	21	20.99	20.91	20.58	20.18	19.88	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.77	0.54	0.37	0.43	0.74	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.61	18.81	19.17	19.63	19.94	20.04	20.05	20.05	19.99	19.57	19	18.56	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.14	19.31	19.63	20.03	20.32	20.42	20.43	20.43	20.36	19.97	19.47	19.09	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.14	19.31	19.63	20.03	20.32	20.42	20.43	20.43	20.36	19.97	19.47	19.09	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.92	0.78	0.58	0.41	0.47	0.77	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	519.31	587.9	665.07	730.02	687.36	505.7	339.66	355.53	506.03	541.69	504.44	494.45	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1321.48	1283.61	1169.2	991.08	767.35	517.96	341.19	358.77	557.39	834.72	1101.91	1326.09	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	596.82	467.52	375.07	187.97	59.51	0	0	0	0	218.01	430.18	618.74	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2953.81 (98)

Space heating requirement in kWh/m²/year 34.29 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2953.81	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	3101.5	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2148.97	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2256.41	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	53.58	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		55.74	(330a)

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warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			55.74	(331)
Energy for lighting (calculated in Appendix L)				364.94	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1244.42	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	27.81	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1272.23	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1272.23	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	28.93	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	189.41	(379)
Total CO2, kg/year	sum of (376)…(382) =				1490.56	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17.3	(384)
EI rating (section 14)					84.77	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-2-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.14	(1a) x	2.4	(2a) =	206.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.14	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	206.74	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.71	x1/[1/(1.4)+ 0.04]		=	3.59			(27)
Windows Type 2			1.81	x1/[1/(1.4)+ 0.04]		=	2.4			(27)
Windows Type 3			1.81	x1/[1/(1.4)+ 0.04]		=	2.4			(27)
Windows Type 4			7.91	x1/[1/(1.4)+ 0.04]		=	10.49			(27)
Windows Type 5			5.2	x1/[1/(1.4)+ 0.04]		=	6.89			(27)
Floor			86.14	x	0.13	=	11.1982			(28)
Walls Type1	44.62	19.44	25.18	x	0.18	=	4.53			(29)
Walls Type2	5.87	2.1	3.77	x	0.18	=	0.68			(29)
Total area of elements, m²			136.63							(31)
Party wall			44.11	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 44.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.46 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 58.74 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.37	40.12	39.89	38.77	38.56	37.58	37.58	37.4	37.96	38.56	38.98	39.42	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	99.11	98.86	98.62	97.51	97.3	96.32	96.32	96.14	96.7	97.3	97.72	98.16	

Average = $Sum(39)_{1…12}$ /12= 97.51 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.15	1.15	1.14	1.13	1.13	1.12	1.12	1.12	1.12	1.13	1.13	1.14	

Average = $Sum(40)_{1…12}$ /12= 1.13 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.74	100.93	97.12	93.31	89.5	85.69	85.69	89.5	93.31	97.12	100.93	104.74	

Total = $Sum(44)_{1…12}$ = 1142.6 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.32	135.85	140.18	122.21	117.27	101.19	93.77	107.6	108.89	126.9	138.52	150.42	

Total = $Sum(45)_{1…12}$ = 1498.13 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.3	20.38	21.03	18.33	17.59	15.18	14.07	16.14	16.33	19.03	20.78	22.56	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.92	177.93	186.78	167.31	163.86	146.28	140.36	154.2	153.98	173.49	183.61	197.02	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.92	177.93	186.78	167.31	163.86	146.28	140.36	154.2	153.98	173.49	183.61	197.02

Output from water heater (annual)$_{1…12}$ — 2046.74 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	88.92	78.84	83.89	76.71	76.27	69.72	68.45	73.05	72.28	79.47	82.13	87.29	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.66	18.35	14.92	11.3	8.45	7.13	7.7	10.01	13.44	17.07	19.92	21.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	231.79	234.2	228.14	215.23	198.95	183.64	173.41	171	177.07	189.97	206.26	221.57	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	(71)

Water heating gains (Table 5)

(72)m=	119.52	117.32	112.75	106.54	102.51	96.83	92.01	98.19	100.39	106.81	114.07	117.33	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	436.51	434.41	420.35	397.61	374.44	352.14	337.66	343.75	355.43	378.39	404.79	424.67	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	2.71	x	10.63	x	0.63	x	0.7	=	8.81	(74)
North	0.9x	0.77	x	1.81	x	10.63	x	0.63	x	0.7	=	5.88	(74)
North	0.9x	0.77	x	1.81	x	10.63	x	0.63	x	0.7	=	5.88	(74)
North	0.9x	0.77	x	5.2	x	10.63	x	0.63	x	0.7	=	16.9	(74)
North	0.9x	0.77	x	2.71	x	20.32	x	0.63	x	0.7	=	16.83	(74)
North	0.9x	0.77	x	1.81	x	20.32	x	0.63	x	0.7	=	11.24	(74)
North	0.9x	0.77	x	1.81	x	20.32	x	0.63	x	0.7	=	11.24	(74)
North	0.9x	0.77	x	5.2	x	20.32	x	0.63	x	0.7	=	32.29	(74)
North	0.9x	0.77	x	2.71	x	34.53	x	0.63	x	0.7	=	28.6	(74)
North	0.9x	0.77	x	1.81	x	34.53	x	0.63	x	0.7	=	19.1	(74)
North	0.9x	0.77	x	1.81	x	34.53	x	0.63	x	0.7	=	19.1	(74)
North	0.9x	0.77	x	5.2	x	34.53	x	0.63	x	0.7	=	54.88	(74)
North	0.9x	0.77	x	2.71	x	55.46	x	0.63	x	0.7	=	45.94	(74)
North	0.9x	0.77	x	1.81	x	55.46	x	0.63	x	0.7	=	30.68	(74)
North	0.9x	0.77	x	1.81	x	55.46	x	0.63	x	0.7	=	30.68	(74)
North	0.9x	0.77	x	5.2	x	55.46	x	0.63	x	0.7	=	88.14	(74)
North	0.9x	0.77	x	2.71	x	74.72	x	0.63	x	0.7	=	61.88	(74)
North	0.9x	0.77	x	1.81	x	74.72	x	0.63	x	0.7	=	41.33	(74)
North	0.9x	0.77	x	1.81	x	74.72	x	0.63	x	0.7	=	41.33	(74)
North	0.9x	0.77	x	5.2	x	74.72	x	0.63	x	0.7	=	118.74	(74)
North	0.9x	0.77	x	2.71	x	79.99	x	0.63	x	0.7	=	66.24	(74)
North	0.9x	0.77	x	1.81	x	79.99	x	0.63	x	0.7	=	44.24	(74)
North	0.9x	0.77	x	1.81	x	79.99	x	0.63	x	0.7	=	44.24	(74)
North	0.9x	0.77	x	5.2	x	79.99	x	0.63	x	0.7	=	127.11	(74)
North	0.9x	0.77	x	2.71	x	74.68	x	0.63	x	0.7	=	61.85	(74)
North	0.9x	0.77	x	1.81	x	74.68	x	0.63	x	0.7	=	41.31	(74)
North	0.9x	0.77	x	1.81	x	74.68	x	0.63	x	0.7	=	41.31	(74)
North	0.9x	0.77	x	5.2	x	74.68	x	0.63	x	0.7	=	118.68	(74)
North	0.9x	0.77	x	2.71	x	59.25	x	0.63	x	0.7	=	49.07	(74)
North	0.9x	0.77	x	1.81	x	59.25	x	0.63	x	0.7	=	32.77	(74)
North	0.9x	0.77	x	1.81	x	59.25	x	0.63	x	0.7	=	32.77	(74)
North	0.9x	0.77	x	5.2	x	59.25	x	0.63	x	0.7	=	94.15	(74)
North	0.9x	0.77	x	2.71	x	41.52	x	0.63	x	0.7	=	34.38	(74)
North	0.9x	0.77	x	1.81	x	41.52	x	0.63	x	0.7	=	22.97	(74)
North	0.9x	0.77	x	1.81	x	41.52	x	0.63	x	0.7	=	22.97	(74)
North	0.9x	0.77	x	5.2	x	41.52	x	0.63	x	0.7	=	65.98	(74)
North	0.9x	0.77	x	2.71	x	24.19	x	0.63	x	0.7	=	20.03	(74)
North	0.9x	0.77	x	1.81	x	24.19	x	0.63	x	0.7	=	13.38	(74)
North	0.9x	0.77	x	1.81	x	24.19	x	0.63	x	0.7	=	13.38	(74)
North	0.9x	0.77	x	5.2	x	24.19	x	0.63	x	0.7	=	38.44	(74)
North	0.9x	0.77	x	2.71	x	13.12	x	0.63	x	0.7	=	10.86	(74)

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North	0.9x	0.77	x	1.81	x	13.12	x	0.63	x	0.7	=	7.26	(74)
North	0.9x	0.77	x	1.81	x	13.12	x	0.63	x	0.7	=	7.26	(74)
North	0.9x	0.77	x	5.2	x	13.12	x	0.63	x	0.7	=	20.85	(74)
North	0.9x	0.77	x	2.71	x	8.86	x	0.63	x	0.7	=	7.34	(74)
North	0.9x	0.77	x	1.81	x	8.86	x	0.63	x	0.7	=	4.9	(74)
North	0.9x	0.77	x	1.81	x	8.86	x	0.63	x	0.7	=	4.9	(74)
North	0.9x	0.77	x	5.2	x	8.86	x	0.63	x	0.7	=	14.09	(74)
East	0.9x	1	x	7.91	x	19.64	x	0.63	x	0.7	=	47.48	(76)
East	0.9x	1	x	7.91	x	38.42	x	0.63	x	0.7	=	92.88	(76)
East	0.9x	1	x	7.91	x	63.27	x	0.63	x	0.7	=	152.96	(76)
East	0.9x	1	x	7.91	x	92.28	x	0.63	x	0.7	=	223.08	(76)
East	0.9x	1	x	7.91	x	113.09	x	0.63	x	0.7	=	273.39	(76)
East	0.9x	1	x	7.91	x	115.77	x	0.63	x	0.7	=	279.86	(76)
East	0.9x	1	x	7.91	x	110.22	x	0.63	x	0.7	=	266.44	(76)
East	0.9x	1	x	7.91	x	94.68	x	0.63	x	0.7	=	228.87	(76)
East	0.9x	1	x	7.91	x	73.59	x	0.63	x	0.7	=	177.89	(76)
East	0.9x	1	x	7.91	x	45.59	x	0.63	x	0.7	=	110.21	(76)
East	0.9x	1	x	7.91	x	24.49	x	0.63	x	0.7	=	59.2	(76)
East	0.9x	1	x	7.91	x	16.15	x	0.63	x	0.7	=	39.04	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	84.95	164.48	274.63	418.52	536.67	561.71	529.58	437.64	324.19	195.44	105.42	70.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.46	598.89	694.98	816.13	911.11	913.85	867.24	781.38	679.62	573.83	510.21	494.95	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.83	0.64	0.48	0.55	0.83	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.76	19.91	20.19	20.56	20.84	20.97	20.99	20.99	20.89	20.51	20.07	19.74	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.96	19.96	19.96	19.97	19.98	19.99	19.99	19.99	19.98	19.98	19.97	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.78	0.55	0.37	0.44	0.75	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.31	18.53	18.93	19.46	19.83	19.97	19.98	19.98	19.89	19.4	18.77	18.28	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.89	19.09	19.43	19.9	20.23	20.37	20.39	20.39	20.29	19.84	19.29	18.86	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.89	19.09	19.43	19.9	20.23	20.37	20.39	20.39	20.29	19.84	19.29	18.86	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.79	0.59	0.42	0.48	0.78	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	519.47	594.13	679.81	756.17	724.15	537.78	362.38	378.11	529.67	551.36	506.26	493.48	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1446.19	1402.48	1275.63	1072.29	830.11	555.47	364.86	383.15	598.55	899.23	1191.25	1439.54	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	689.48	543.21	443.29	227.61	78.84	0	0	0	0	258.82	493.19	703.86	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3438.3 (98)

Space heating requirement in kWh/m²/year 39.92 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	689.48	543.21	443.29	227.61	78.84	0	0	0	0	258.82	493.19	703.86		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	737.41	580.98	474.11	243.43	84.32	0	0	0	0	276.81	527.48	752.79		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3677.33	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	201.92	177.93	186.78	167.31	163.86	146.28	140.36	154.2	153.98	173.49	183.61	197.02		
Efficiency of water heater													79.8	(216)
(217)m=	87.83	87.6	87.04	85.64	82.99	79.8	79.8	79.8	79.8	85.88	87.32	87.92		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	229.89	203.12	214.59	195.37	197.45	183.31	175.9	193.23	192.96	202.02	210.27	224.08		
Total = Sum(219a)$_{1...12}$ =													2422.18	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3677.33

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Water heating fuel used			2422.18	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			364.88	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	794.3	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	523.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1317.49	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.37	(268)
Total CO2, kg/year		sum of (265)…(271) =		1545.79	(272)

TER = 17.95 (273)

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User Details:

Assessor Name: **Stroma Number:**
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.8

Property Address: b1-2-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	71.42	(1a)	x	2.4	(2a)	=	171.41	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.42	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	171.41	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Floor			71.42	x	0.11	=	7.8562			(28)
Walls Type1	28.74	10.12	18.62	x	0.18	=	3.35			(29)
Walls Type2	43.06	2.1	40.96	x	0.18	=	7.37			(29)
Total area of elements, m²			143.22							(31)
Party wall			14.79	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	32.69	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		13.68	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	46.37	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	74.65	74.65	74.65	74.65	74.65	74.65	74.65	74.65	74.65	74.65	74.65	74.65

Average = Sum(39)$_{1…12}$ /12= 74.65 (39)

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Heat loss parameter (HLP), W/m²K　　(40)m = (39)m ÷ (4)

(40)m=	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05

Average = Sum(40)$_{1…12}$ /12= 1.05 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.28 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	97.19	93.65	90.12	86.59	83.05	79.52	79.52	83.05	86.59	90.12	93.65	97.19	
									Total = Sum(44)$_{1…12}$ =			1060.23	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	144.13	126.05	130.08	113.4	108.81	93.9	87.01	99.85	101.04	117.75	128.53	139.58	
									Total = Sum(45)$_{1…12}$ =			1390.13	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	21.62	18.91	19.51	17.01	16.32	14.08	13.05	14.98	15.16	17.66	19.28	20.94	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.4	175.98	185.35	166.9	164.09	147.39	142.29	155.12	154.53	173.03	182.03	194.86	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.4	175.98	185.35	166.9	164.09	147.39	142.29	155.12	154.53	173.03	182.03	194.86	

Output from water heater (annual)$_{1...12}$ 2040.97 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.14	81.85	87.47	80.5	80.4	74.02	73.15	77.42	76.39	83.37	85.53	90.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114	114	114	114	114	114	114	114	114	114	114	114	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	18.61	16.53	13.44	10.18	7.61	6.42	6.94	9.02	12.11	15.37	17.94	19.13	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	200.59	202.67	197.42	186.26	172.16	158.91	150.06	147.98	153.23	164.39	178.49	191.74	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	(71)
Water heating gains (Table 5)													
(72)m=	123.85	121.81	117.57	111.81	108.07	102.8	98.32	104.06	106.1	112.06	118.79	121.82	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	400.25	398.21	385.64	365.45	345.04	325.34	312.53	318.26	328.64	349.03	372.43	389.89	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)

East	0.9x	1	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	55.1	107.78	177.5	258.87	317.25	324.77	309.19	265.59	206.44	127.89	68.7	45.31	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	455.35	505.99	563.14	624.32	662.29	650.11	621.72	583.86	535.07	476.92	441.13	435.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.95	0.86	0.69	0.52	0.57	0.83	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.94	20.06	20.29	20.59	20.84	20.96	20.99	20.99	20.9	20.58	20.2	19.9	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.82	0.61	0.41	0.46	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.63	18.81	19.15	19.56	19.89	20.02	20.04	20.04	19.97	19.56	19.01	18.58	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.15	19.31	19.6	19.97	20.27	20.4	20.42	20.42	20.34	19.97	19.48	19.11	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.15	19.31	19.6	19.97	20.27	20.4	20.42	20.42	20.34	19.97	19.48	19.11	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.83	0.64	0.46	0.51	0.78	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	453.2	501.5	550.87	584.46	549.22	415.68	283.15	296.14	417.77	456.16	436.94	433.57	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1108.75	1075.94	978.27	826.55	639.46	432.83	285.42	300.13	466.02	699.27	924.45	1112.73	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	487.73	386.03	317.99	174.3	67.14	0	0	0	0	180.87	351.01	505.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2470.36 (98)

Space heating requirement in kWh/m²/year 34.59 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2470.36	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2593.88	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308

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Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2040.97	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2143.01	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	47.37	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.22	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	46.22	(331)
Energy for lighting (calculated in Appendix L)		328.7	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1100.18	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	24.58	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1124.77	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1124.77	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	23.99	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	170.6	(379)
Total CO2, kg/year	sum of (376)…(382) =				1319.35	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				18.47	(384)
EI rating (section 14)					84.81	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-2-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	71.42	(1a)	x	2.4	(2a)	=	171.41	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.42	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			171.41	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.43	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Floor			71.42	x	0.13	=	9.284599			(28)
Walls Type1	28.74	10.12	18.62	x	0.18	=	3.35			(29)
Walls Type2	43.06	2.1	40.96	x	0.18	=	7.37			(29)
Total area of elements, m²			143.22							(31)
Party wall			14.79	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.53 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.61 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 50.14 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.28	34.05	33.82	32.75	32.55	31.61	31.61	31.44	31.97	32.55	32.95	33.38	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	84.42	84.19	83.96	82.89	82.69	81.75	81.75	81.58	82.11	82.69	83.09	83.52	

Average = Sum(39)$_{1…12}$ /12= 82.89 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.18	1.18	1.18	1.16	1.16	1.14	1.14	1.14	1.15	1.16	1.16	1.17

Average = Sum(40)$_{1…12}$ /12= 1.16 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.28 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	97.19	93.65	90.12	86.59	83.05	79.52	79.52	83.05	86.59	90.12	93.65	97.19	
										Total = Sum(44)$_{1…12}$ =		1060.23	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	144.13	126.05	130.08	113.4	108.81	93.9	87.01	99.85	101.04	117.75	128.53	139.58	
										Total = Sum(45)$_{1…12}$ =		1390.13	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	21.62	18.91	19.51	17.01	16.32	14.08	13.05	14.98	15.16	17.66	19.28	20.94	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	190.72	168.14	176.67	158.5	155.41	138.99	133.61	146.44	146.13	164.34	173.63	186.17	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	190.72	168.14	176.67	158.5	155.41	138.99	133.61	146.44	146.13	164.34	173.63	186.17	

Output from water heater (annual)$_{1...12}$ 1938.74 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.2	75.58	80.53	73.78	73.46	67.29	66.21	70.47	69.67	76.43	78.81	83.69	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114	114	114	114	114	114	114	114	114	114	114	114	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	19.13	17	13.82	10.46	7.82	6.6	7.14	9.27	12.45	15.81	18.45	19.67	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	200.59	202.67	197.42	186.26	172.16	158.91	150.06	147.98	153.23	164.39	178.49	191.74	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	(71)
Water heating gains (Table 5)													
(72)m=	114.51	112.47	108.23	102.47	98.73	93.46	88.99	94.72	96.76	102.73	109.46	112.48	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	394.44	392.34	379.68	359.4	338.92	319.18	306.39	312.18	322.64	343.13	366.6	384.09	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)

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East	0.9x	1	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	60.74	118.83	195.69	285.4	349.77	358.06	340.88	292.81	227.6	141	75.74	49.95	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	455.18	511.17	575.37	644.8	688.69	677.24	647.27	605	550.24	484.13	442.34	434.04	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.96	0.88	0.71	0.54	0.6	0.85	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.75	19.89	20.15	20.49	20.78	20.95	20.99	20.98	20.87	20.49	20.06	19.73	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.94	19.94	19.95	19.95	19.96	19.96	19.97	19.96	19.95	19.95	19.94	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.83	0.62	0.42	0.47	0.77	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.28	18.48	18.86	19.36	19.74	19.93	19.96	19.96	19.85	19.36	18.74	18.25	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.87	19.05	19.38	19.81	20.16	20.34	20.37	20.37	20.26	19.81	19.27	18.84	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.87	19.05	19.38	19.81	20.16	20.34	20.37	20.37	20.26	19.81	19.27	18.84	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.84	0.65	0.47	0.52	0.8	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	453.01	506.62	563.13	605.4	578.22	443.57	304.47	317.2	438.55	464.53	438.26	432.39	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1229.63	1191.04	1081.04	904.48	699.27	468.9	308.35	323.74	505.72	761.81	1011.22	1222.9	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	577.81	459.93	385.32	215.34	90.06	0	0	0	0	221.17	412.53	588.14	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2950.31 (98)

Space heating requirement in kWh/m²/year 41.31 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	577.81	459.93	385.32	215.34	90.06	0	0	0	0	221.17	412.53	588.14	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	617.98	491.9	412.11	230.31	96.32	0	0	0	0	236.55	441.21	629.03	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3155.41 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

190.72	168.14	176.67	158.5	155.41	138.99	133.61	146.44	146.13	164.34	173.63	186.17

Efficiency of water heater | 79.8 | (216)

(217)m=	87.59	87.36	86.84	85.63	83.42	79.8	79.8	79.8	79.8	85.61	87.04	87.67	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	217.75	192.46	203.45	185.09	186.3	174.17	167.42	183.51	183.12	191.98	199.47	212.35

Total = Sum(219a)$_{1...12}$ = | 2297.07 | (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3155.41	
Water heating fuel used		2297.07	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year — sum of (230a)…(230g) =		75	(231)
Electricity for lighting		337.92	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	681.57	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	496.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1177.74	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	175.38	(268)
Total CO2, kg/year			sum of (265)…(271) =		1392.04	(272)

TER = 19.49 (273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-2-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.01	(1a) x	2.4	(2a) =	127.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.01	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	127.22	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Floor			53.01	x	0.11	=	5.8311			(28)
Walls Type1	37.55	11.96	25.59	x	0.18	=	4.61			(29)
Walls Type2	25.99	2.1	23.89	x	0.18	=	4.3			(29)
Total area of elements, m²			116.55							(31)
Party wall			14.75	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.95 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.93 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 43.89 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.88	64.88	64.88	64.88	64.88	64.88	64.88	64.88	64.88	64.88	64.88	64.88	

Average = Sum(39)$_{1...12}$ /12= 64.88 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	

Average = Sum(40)$_{1...12}$ /12= 1.22 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.78 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 76.45 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	84.09	81.03	77.98	74.92	71.86	68.8	68.8	71.86	74.92	77.98	81.03	84.09	

Total = Sum(44)$_{1...12}$ = 917.37 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	124.71	109.07	112.55	98.12	94.15	81.25	75.29	86.39	87.42	101.88	111.21	120.77	

Total = Sum(45)$_{1...12}$ = 1202.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.71	16.36	16.88	14.72	14.12	12.19	11.29	12.96	13.11	15.28	16.68	18.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.98	159	167.83	151.62	149.43	134.74	130.56	141.67	140.92	157.16	164.71	176.05	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.98	159	167.83	151.62	149.43	134.74	130.56	141.67	140.92	157.16	164.71	176.05

Output from water heater (annual)$_{1...12}$ | 1853.66 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.69	76.21	81.64	75.42	75.53	69.81	69.25	72.95	71.86	78.1	79.77	84.38	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.82	12.28	9.98	7.56	5.65	4.77	5.15	6.7	8.99	11.42	13.33	14.21	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	155.04	156.65	152.6	143.97	133.07	122.83	115.99	114.38	118.44	127.07	137.96	148.2	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	(71)

Water heating gains (Table 5)

(72)m=	115.17	113.4	109.74	104.75	101.51	96.96	93.08	98.05	99.81	104.97	110.8	113.41	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	333.72	332.02	322	305.96	289.92	274.24	263.91	268.81	276.92	293.14	311.77	325.5	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)

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East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)

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South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	113.51	195.48	270.93	337.99	378.11	374.49	361.47	332.12	294.49	217.19	136.4	96.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	447.23	527.49	592.93	643.95	668.03	648.73	625.38	600.93	571.41	510.33	448.17	422.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.78	0.61	0.45	0.49	0.71	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.88	20.08	20.35	20.64	20.86	20.97	20.99	20.99	20.93	20.64	20.19	19.83	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.94	0.87	0.72	0.52	0.34	0.38	0.63	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.44	18.73	19.11	19.5	19.77	19.88	19.9	19.9	19.85	19.52	18.89	18.36	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.16	19.4	19.73	20.07	20.32	20.42	20.45	20.44	20.39	20.08	19.54	19.1	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.16	19.4	19.73	20.07	20.32	20.42	20.45	20.44	20.39	20.08	19.54	19.1	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.87	0.75	0.56	0.4	0.43	0.67	0.89	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	441.08	512.4	557.48	561.57	498.51	365.39	247.68	259.55	380.94	456.41	435.81	417.76	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	964.18	940.87	858.11	724.72	559.01	377.83	249.54	262.38	408.16	614.99	807.3	966.46	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	389.19	287.93	223.67	117.47	45.01	0	0	0	0	117.98	267.47	408.23	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1856.97 | (98)

Space heating requirement in kWh/m²/year | 35.03 | (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1856.97	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1949.82	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1853.66	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1946.34	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	38.96	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		34.3	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	34.3	(331)
Energy for lighting (calculated in Appendix L)		244.11	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	904.92	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	20.22	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	925.14	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				925.14	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	17.8	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	126.69	(379)
Total CO2, kg/year	sum of (376)…(382) =			1069.63	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			20.18	(384)
EI rating (section 14)				85.38	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-2-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.01	(1a) x	2.4	(2a) =	127.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.01	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	127.22	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.29	x1/[1/(1.4)+ 0.04]		=	5.69			(27)
Windows Type 2			2.57	x1/[1/(1.4)+ 0.04]		=	3.41			(27)
Windows Type 3			2.57	x1/[1/(1.4)+ 0.04]		=	3.41			(27)
Windows Type 4			1.72	x1/[1/(1.4)+ 0.04]		=	2.28			(27)
Floor			53.01	x	0.13	=	6.8913			(28)
Walls Type1	37.55	11.15	26.4	x	0.18	=	4.75			(29)
Walls Type2	25.99	2.1	23.89	x	0.18	=	4.3			(29)
Total area of elements, m²			116.55							(31)
Party wall			14.75	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	32.83	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		13.77	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	46.59	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	25.08	24.92	24.77	24.03	23.9	23.26	23.26	23.14	23.51	23.9	24.17	24.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	71.67	71.51	71.36	70.63	70.49	69.85	69.85	69.74	70.1	70.49	70.77	71.06	

Average = Sum(39)$_{1…12}$ /12= 70.63 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.35	1.35	1.35	1.33	1.33	1.32	1.32	1.32	1.32	1.33	1.33	1.34	

Average = Sum(40)$_{1…12}$ /12= 1.33 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.78 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 76.45 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	84.09	81.03	77.98	74.92	71.86	68.8	68.8	71.86	74.92	77.98	81.03	84.09	

Total = Sum(44)$_{1…12}$ = 917.37 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	124.71	109.07	112.55	98.12	94.15	81.25	75.29	86.39	87.42	101.88	111.21	120.77	

Total = Sum(45)$_{1…12}$ = 1202.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.71	16.36	16.88	14.72	14.12	12.19	11.29	12.96	13.11	15.28	16.68	18.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	171.3	151.16	159.14	143.22	140.75	126.34	121.88	132.99	132.52	148.48	156.31	167.37	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	171.3	151.16	159.14	143.22	140.75	126.34	121.88	132.99	132.52	148.48	156.31	167.37

Output from water heater (annual)$_{1…12}$	1751.44	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	78.74	69.93	74.7	68.7	68.58	63.09	62.31	66	65.14	71.15	73.05	77.43	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.86	12.31	10.01	7.58	5.67	4.78	5.17	6.72	9.02	11.45	13.36	14.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	155.04	156.65	152.6	143.97	133.07	122.83	115.99	114.38	118.44	127.07	137.96	148.2	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	(71)

Water heating gains (Table 5)

(72)m=	105.83	104.07	100.4	95.42	92.18	87.62	83.75	88.71	90.47	95.64	101.46	104.08	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	327.42	325.71	315.69	299.64	283.6	267.92	257.59	262.49	270.61	286.83	305.47	319.21	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.57	x	19.64	x	0.63	x	0.7	=	15.43	(76)
East	0.9x	1	x	2.57	x	19.64	x	0.63	x	0.7	=	15.43	(76)

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East	0.9x	1	x	2.57	x	38.42	x	0.63	x	0.7	=	30.18	(76)
East	0.9x	1	x	2.57	x	38.42	x	0.63	x	0.7	=	30.18	(76)
East	0.9x	1	x	2.57	x	63.27	x	0.63	x	0.7	=	49.7	(76)
East	0.9x	1	x	2.57	x	63.27	x	0.63	x	0.7	=	49.7	(76)
East	0.9x	1	x	2.57	x	92.28	x	0.63	x	0.7	=	72.48	(76)
East	0.9x	1	x	2.57	x	92.28	x	0.63	x	0.7	=	72.48	(76)
East	0.9x	1	x	2.57	x	113.09	x	0.63	x	0.7	=	88.83	(76)
East	0.9x	1	x	2.57	x	113.09	x	0.63	x	0.7	=	88.83	(76)
East	0.9x	1	x	2.57	x	115.77	x	0.63	x	0.7	=	90.93	(76)
East	0.9x	1	x	2.57	x	115.77	x	0.63	x	0.7	=	90.93	(76)
East	0.9x	1	x	2.57	x	110.22	x	0.63	x	0.7	=	86.57	(76)
East	0.9x	1	x	2.57	x	110.22	x	0.63	x	0.7	=	86.57	(76)
East	0.9x	1	x	2.57	x	94.68	x	0.63	x	0.7	=	74.36	(76)
East	0.9x	1	x	2.57	x	94.68	x	0.63	x	0.7	=	74.36	(76)
East	0.9x	1	x	2.57	x	73.59	x	0.63	x	0.7	=	57.8	(76)
East	0.9x	1	x	2.57	x	73.59	x	0.63	x	0.7	=	57.8	(76)
East	0.9x	1	x	2.57	x	45.59	x	0.63	x	0.7	=	35.81	(76)
East	0.9x	1	x	2.57	x	45.59	x	0.63	x	0.7	=	35.81	(76)
East	0.9x	1	x	2.57	x	24.49	x	0.63	x	0.7	=	19.23	(76)
East	0.9x	1	x	2.57	x	24.49	x	0.63	x	0.7	=	19.23	(76)
East	0.9x	1	x	2.57	x	16.15	x	0.63	x	0.7	=	12.69	(76)
East	0.9x	1	x	2.57	x	16.15	x	0.63	x	0.7	=	12.69	(76)
South	0.9x	0.77	x	4.29	x	46.75	x	0.63	x	0.7	=	61.3	(78)
South	0.9x	0.77	x	1.72	x	46.75	x	0.63	x	0.7	=	24.58	(78)
South	0.9x	0.77	x	4.29	x	76.57	x	0.63	x	0.7	=	100.39	(78)
South	0.9x	0.77	x	1.72	x	76.57	x	0.63	x	0.7	=	40.25	(78)
South	0.9x	0.77	x	4.29	x	97.53	x	0.63	x	0.7	=	127.87	(78)
South	0.9x	0.77	x	1.72	x	97.53	x	0.63	x	0.7	=	51.27	(78)
South	0.9x	0.77	x	4.29	x	110.23	x	0.63	x	0.7	=	144.53	(78)
South	0.9x	0.77	x	1.72	x	110.23	x	0.63	x	0.7	=	57.95	(78)
South	0.9x	0.77	x	4.29	x	114.87	x	0.63	x	0.7	=	150.61	(78)
South	0.9x	0.77	x	1.72	x	114.87	x	0.63	x	0.7	=	60.38	(78)
South	0.9x	0.77	x	4.29	x	110.55	x	0.63	x	0.7	=	144.94	(78)
South	0.9x	0.77	x	1.72	x	110.55	x	0.63	x	0.7	=	58.11	(78)
South	0.9x	0.77	x	4.29	x	108.01	x	0.63	x	0.7	=	141.61	(78)
South	0.9x	0.77	x	1.72	x	108.01	x	0.63	x	0.7	=	56.78	(78)
South	0.9x	0.77	x	4.29	x	104.89	x	0.63	x	0.7	=	137.53	(78)
South	0.9x	0.77	x	1.72	x	104.89	x	0.63	x	0.7	=	55.14	(78)
South	0.9x	0.77	x	4.29	x	101.89	x	0.63	x	0.7	=	133.58	(78)
South	0.9x	0.77	x	1.72	x	101.89	x	0.63	x	0.7	=	53.56	(78)
South	0.9x	0.77	x	4.29	x	82.59	x	0.63	x	0.7	=	108.28	(78)

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South	0.9x	0.77	x	1.72	x	82.59	x	0.63	x	0.7	=	43.41	(78)
South	0.9x	0.77	x	4.29	x	55.42	x	0.63	x	0.7	=	72.66	(78)
South	0.9x	0.77	x	1.72	x	55.42	x	0.63	x	0.7	=	29.13	(78)
South	0.9x	0.77	x	4.29	x	40.4	x	0.63	x	0.7	=	52.97	(78)
South	0.9x	0.77	x	1.72	x	40.4	x	0.63	x	0.7	=	21.24	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	116.72	200.99	278.54	347.43	388.64	384.91	371.53	341.39	302.73	223.3	140.26	99.57	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	444.14	526.7	594.23	647.07	672.24	652.82	629.12	603.88	573.34	510.13	445.72	418.78	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.91	0.81	0.64	0.48	0.52	0.74	0.93	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.71	19.92	20.21	20.54	20.81	20.95	20.99	20.98	20.9	20.56	20.07	19.67	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.8	19.8	19.8	19.82	19.82	19.83	19.83	19.83	19.82	19.82	19.81	19.81	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.88	0.75	0.54	0.36	0.39	0.65	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.12	18.42	18.84	19.31	19.64	19.8	19.82	19.82	19.75	19.34	18.65	18.07	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.91	19.17	19.52	19.93	20.22	20.37	20.41	20.4	20.33	19.95	19.36	18.87	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.91	19.17	19.52	19.93	20.22	20.37	20.41	20.4	20.33	19.95	19.36	18.87	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.95	0.88	0.77	0.59	0.42	0.45	0.69	0.9	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	438.34	512.72	561.97	572.16	516.89	384.43	262.72	274.56	397.2	461.63	434.36	414.43	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1047.42	1020.5	929.36	778.89	600.83	403.29	265.89	279.23	436.49	658.98	867.43	1042.35	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	453.16	341.22	273.34	148.85	62.45	0	0	0	0	146.83	311.81	467.17	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2204.82 (98)

Space heating requirement in kWh/m²/year 41.59 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	453.16	341.22	273.34	148.85	62.45	0	0	0	0	146.83	311.81	467.17		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	484.66	364.94	292.34	159.2	66.79	0	0	0	0	157.04	333.48	499.64		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2358.1	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	171.3	151.16	159.14	143.22	140.75	126.34	121.88	132.99	132.52	148.48	156.31	167.37		
Efficiency of water heater													79.8	(216)
(217)m=	87.29	86.92	86.24	84.92	82.81	79.8	79.8	79.8	79.8	84.78	86.62	87.41		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	196.25	173.9	184.53	168.65	169.97	158.32	152.73	166.65	166.06	175.13	180.45	191.48		
Total = Sum(219a)$_{1...12}$ =													2084.1	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2358.1	
Water heating fuel used			2084.1	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			244.75	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	509.35	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	450.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =				959.51	(265)

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Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	127.02	(268)
Total CO2, kg/year			sum of (265)…(271) =		1125.46	(272)

TER =	21.23	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-2-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	79.03	(1a) x	2.4	(2a) =	189.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.03	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	189.67	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Floor			79.03	x	0.11	=	8.6933			(28)
Walls Type1	42.8	18.86	23.94	x	0.18	=	4.31			(29)
Walls Type2	13.9	2.1	11.8	x	0.18	=	2.12			(29)
Total area of elements, m²			135.73							(31)
Party wall			39.79	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.24 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.29 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 54.53 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3		(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	85.83	85.83	85.83	85.83	85.83	85.83	85.83	85.83	85.83	85.83	85.83	85.83		
										Average = Sum(39)1…12 /12=			85.83	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09		
										Average = Sum(40)1…12 /12=			1.09	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.44 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)														
(44)m=	101.47	97.78	94.09	90.4	86.71	83.02	83.02	86.71	90.4	94.09	97.78	101.47		
										Total = Sum(44)1…12 =			1107	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)														
(45)m=	150.48	131.61	135.81	118.41	113.61	98.04	90.85	104.25	105.49	122.94	134.2	145.74		
										Total = Sum(45)1…12 =			1451.45	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)														
(46)m=	22.57	19.74	20.37	17.76	17.04	14.71	13.63	15.64	15.82	18.44	20.13	21.86		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.76	181.54	191.09	171.9	168.89	151.53	146.13	159.53	158.99	178.22	187.7	201.01	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.76	181.54	191.09	171.9	168.89	151.53	146.13	159.53	158.99	178.22	187.7	201.01

Output from water heater (annual)$_{1…12}$ — 2102.29 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	94.26	83.7	89.38	82.16	82	75.39	74.43	78.88	77.87	85.1	87.42	92.68	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.38	17.21	14	10.6	7.92	6.69	7.23	9.39	12.61	16.01	18.69	19.92	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	217.4	219.66	213.97	201.87	186.59	172.23	162.64	160.39	166.07	178.17	193.45	207.81	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	(71)

Water heating gains (Table 5)

(72)m=	126.69	124.56	120.13	114.12	110.21	104.71	100.04	106.03	108.16	114.38	121.41	124.57	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	423.14	421.09	407.77	386.25	364.39	343.3	329.57	335.47	346.5	368.23	393.21	411.96	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	5.29	x	46.75	x	0.5	x	0.8	=	68.56	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	5.29	x	76.57	x	0.5	x	0.8	=	112.28	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	5.29	x	97.53	x	0.5	x	0.8	=	143.02	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	5.29	x	110.23	x	0.5	x	0.8	=	161.65	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	5.29	x	114.87	x	0.5	x	0.8	=	168.45	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	5.29	x	110.55	x	0.5	x	0.8	=	162.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	5.29	x	108.01	x	0.5	x	0.8	=	158.39	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	5.29	x	104.89	x	0.5	x	0.8	=	153.82	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	5.29	x	101.89	x	0.5	x	0.8	=	149.4	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	5.29	x	82.59	x	0.5	x	0.8	=	121.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	5.29	x	55.42	x	0.5	x	0.8	=	81.26	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	5.29	x	40.4	x	0.5	x	0.8	=	59.24	(78)
West	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	183.92	315.17	433.45	536.24	596.58	589.6	569.61	525.59	469.52	349.2	220.71	157.09	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	607.06	736.27	841.22	922.49	960.97	932.9	899.18	861.06	816.01	717.43	613.92	569.06	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.89	0.75	0.57	0.42	0.45	0.68	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.21	20.47	20.73	20.91	20.98	21	21	20.96	20.72	20.29	19.95	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.85	0.7	0.49	0.33	0.36	0.6	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.7	19	19.36	19.72	19.93	20	20.01	20.01	19.98	19.71	19.12	18.62	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.22	19.48	19.81	20.13	20.32	20.39	20.41	20.4	20.37	20.11	19.59	19.15	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.22	19.48	19.81	20.13	20.32	20.39	20.41	20.4	20.37	20.11	19.59	19.15	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.86	0.71	0.52	0.36	0.4	0.63	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	600.71	716.98	789.22	791.5	686.68	488.64	325.61	342.05	516.23	638.03	599.52	564.64	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1280.46	1251.39	1142.04	963.43	740.14	497.28	326.62	343.7	538.39	816.39	1071.86	1283.09	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	505.73	359.12	262.5	123.79	39.77	0	0	0	0	132.7	340.09	534.53	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2298.22	(98)
Space heating requirement in kWh/m²/year	29.08	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2298.22	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2413.14	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2102.29	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2207.4	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	46.21	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		51.14	(330a)

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warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =		51.14	(331)
Energy for lighting (calculated in Appendix L)			342.28	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)				
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	= 1073.16	(367)
Electrical energy for heat distribution	[(313) x	0.52	= 23.98	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		= 1097.14	(373)
CO2 associated with space heating (secondary)	(309) x	0	= 0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	= 0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		1097.14	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	= 26.54	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	= 177.64	(379)
Total CO2, kg/year	sum of (376)…(382) =		1301.32	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =		16.47	(384)
EI rating (section 14)			85.94	(385)

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User Details:

Assessor Name: | **Stroma Number:**

Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-2-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	79.03	(1a) x	2.4	(2a) =	189.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.03	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	189.67	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.43	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.58	x1/[1/(1.4)+ 0.04]		=	3.42			(27)
Windows Type 2			2.58	x1/[1/(1.4)+ 0.04]		=	3.42			(27)
Windows Type 3			4.95	x1/[1/(1.4)+ 0.04]		=	6.56			(27)
Windows Type 4			2.58	x1/[1/(1.4)+ 0.04]		=	3.42			(27)
Windows Type 5			4.95	x1/[1/(1.4)+ 0.04]		=	6.56			(27)
Floor			79.03	x	0.13	=	10.2739			(28)
Walls Type1	42.8	17.64	25.16	x	0.18	=	4.53			(29)
Walls Type2	13.9	2.1	11.8	x	0.18	=	2.12			(29)
Total area of elements, m²			135.73							(31)
Party wall			39.79	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.41 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.54 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 57.95 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	37.42	37.18	36.95	35.85	35.65	34.7	34.7	34.52	35.06	35.65	36.06	36.5	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	95.37	95.13	94.9	93.81	93.6	92.65	92.65	92.47	93.02	93.6	94.02	94.45	

Average = Sum(39)$_{1…12}$ /12= 93.81 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.21	1.2	1.2	1.19	1.18	1.17	1.17	1.17	1.18	1.18	1.19	1.2	

Average = Sum(40)$_{1…12}$ /12= 1.19 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.44 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	101.47	97.78	94.09	90.4	86.71	83.02	83.02	86.71	90.4	94.09	97.78	101.47

Total = Sum(44)$_{1…12}$ = 1107 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150.48	131.61	135.81	118.41	113.61	98.04	90.85	104.25	105.49	122.94	134.2	145.74

Total = Sum(45)$_{1…12}$ = 1451.45 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.57	19.74	20.37	17.76	17.04	14.71	13.63	15.64	15.82	18.44	20.13	21.86	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	197.08	173.7	182.41	163.5	160.21	143.13	137.44	150.84	150.59	169.54	179.29	192.33	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	197.08	173.7	182.41	163.5	160.21	143.13	137.44	150.84	150.59	169.54	179.29	192.33

Output from water heater (annual)$_{1…12}$ — 2000.06 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	87.31	77.43	82.43	75.44	75.05	68.67	67.48	71.94	71.15	78.15	80.7	85.73	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.38	17.21	14	10.6	7.92	6.69	7.23	9.39	12.61	16.01	18.69	19.92	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	217.4	219.66	213.97	201.87	186.59	172.23	162.64	160.39	166.07	178.17	193.45	207.81	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	(71)

Water heating gains (Table 5)

(72)m=	117.35	115.22	110.8	104.78	100.88	95.38	90.7	96.69	98.82	105.05	112.08	115.23	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	416.8	414.76	401.43	379.91	358.05	336.96	323.23	329.14	340.16	361.89	386.88	405.62	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	2.58	x	46.75	x	0.63	x	0.7	=	36.86	(78)
South	0.9x	0.77	x	2.58	x	46.75	x	0.63	x	0.7	=	36.86	(78)
South	0.9x	0.77	x	4.95	x	46.75	x	0.63	x	0.7	=	70.73	(78)
South	0.9x	0.77	x	2.58	x	76.57	x	0.63	x	0.7	=	60.37	(78)
South	0.9x	0.77	x	2.58	x	76.57	x	0.63	x	0.7	=	60.37	(78)
South	0.9x	0.77	x	4.95	x	76.57	x	0.63	x	0.7	=	115.83	(78)
South	0.9x	0.77	x	2.58	x	97.53	x	0.63	x	0.7	=	76.9	(78)
South	0.9x	0.77	x	2.58	x	97.53	x	0.63	x	0.7	=	76.9	(78)
South	0.9x	0.77	x	4.95	x	97.53	x	0.63	x	0.7	=	147.55	(78)
South	0.9x	0.77	x	2.58	x	110.23	x	0.63	x	0.7	=	86.92	(78)
South	0.9x	0.77	x	2.58	x	110.23	x	0.63	x	0.7	=	86.92	(78)
South	0.9x	0.77	x	4.95	x	110.23	x	0.63	x	0.7	=	166.76	(78)
South	0.9x	0.77	x	2.58	x	114.87	x	0.63	x	0.7	=	90.57	(78)
South	0.9x	0.77	x	2.58	x	114.87	x	0.63	x	0.7	=	90.57	(78)
South	0.9x	0.77	x	4.95	x	114.87	x	0.63	x	0.7	=	173.78	(78)
South	0.9x	0.77	x	2.58	x	110.55	x	0.63	x	0.7	=	87.16	(78)
South	0.9x	0.77	x	2.58	x	110.55	x	0.63	x	0.7	=	87.16	(78)
South	0.9x	0.77	x	4.95	x	110.55	x	0.63	x	0.7	=	167.23	(78)
South	0.9x	0.77	x	2.58	x	108.01	x	0.63	x	0.7	=	85.17	(78)
South	0.9x	0.77	x	2.58	x	108.01	x	0.63	x	0.7	=	85.17	(78)
South	0.9x	0.77	x	4.95	x	108.01	x	0.63	x	0.7	=	163.4	(78)
South	0.9x	0.77	x	2.58	x	104.89	x	0.63	x	0.7	=	82.71	(78)
South	0.9x	0.77	x	2.58	x	104.89	x	0.63	x	0.7	=	82.71	(78)
South	0.9x	0.77	x	4.95	x	104.89	x	0.63	x	0.7	=	158.68	(78)
South	0.9x	0.77	x	2.58	x	101.89	x	0.63	x	0.7	=	80.33	(78)
South	0.9x	0.77	x	2.58	x	101.89	x	0.63	x	0.7	=	80.33	(78)
South	0.9x	0.77	x	4.95	x	101.89	x	0.63	x	0.7	=	154.13	(78)
South	0.9x	0.77	x	2.58	x	82.59	x	0.63	x	0.7	=	65.12	(78)
South	0.9x	0.77	x	2.58	x	82.59	x	0.63	x	0.7	=	65.12	(78)
South	0.9x	0.77	x	4.95	x	82.59	x	0.63	x	0.7	=	124.93	(78)
South	0.9x	0.77	x	2.58	x	55.42	x	0.63	x	0.7	=	43.7	(78)
South	0.9x	0.77	x	2.58	x	55.42	x	0.63	x	0.7	=	43.7	(78)
South	0.9x	0.77	x	4.95	x	55.42	x	0.63	x	0.7	=	83.83	(78)
South	0.9x	0.77	x	2.58	x	40.4	x	0.63	x	0.7	=	31.85	(78)
South	0.9x	0.77	x	2.58	x	40.4	x	0.63	x	0.7	=	31.85	(78)
South	0.9x	0.77	x	4.95	x	40.4	x	0.63	x	0.7	=	61.11	(78)
West	0.9x	0.77	x	4.95	x	19.64	x	0.63	x	0.7	=	29.71	(80)
West	0.9x	0.77	x	2.58	x	19.64	x	0.63	x	0.7	=	15.49	(80)
West	0.9x	0.77	x	4.95	x	38.42	x	0.63	x	0.7	=	58.12	(80)
West	0.9x	0.77	x	2.58	x	38.42	x	0.63	x	0.7	=	30.29	(80)
West	0.9x	0.77	x	4.95	x	63.27	x	0.63	x	0.7	=	95.72	(80)

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West	0.9x	0.77	x	2.58	x	63.27	x	0.63	x	0.7	=	49.89	(80)
West	0.9x	0.77	x	4.95	x	92.28	x	0.63	x	0.7	=	139.6	(80)
West	0.9x	0.77	x	2.58	x	92.28	x	0.63	x	0.7	=	72.76	(80)
West	0.9x	0.77	x	4.95	x	113.09	x	0.63	x	0.7	=	171.08	(80)
West	0.9x	0.77	x	2.58	x	113.09	x	0.63	x	0.7	=	89.17	(80)
West	0.9x	0.77	x	4.95	x	115.77	x	0.63	x	0.7	=	175.14	(80)
West	0.9x	0.77	x	2.58	x	115.77	x	0.63	x	0.7	=	91.28	(80)
West	0.9x	0.77	x	4.95	x	110.22	x	0.63	x	0.7	=	166.74	(80)
West	0.9x	0.77	x	2.58	x	110.22	x	0.63	x	0.7	=	86.91	(80)
West	0.9x	0.77	x	4.95	x	94.68	x	0.63	x	0.7	=	143.22	(80)
West	0.9x	0.77	x	2.58	x	94.68	x	0.63	x	0.7	=	74.65	(80)
West	0.9x	0.77	x	4.95	x	73.59	x	0.63	x	0.7	=	111.32	(80)
West	0.9x	0.77	x	2.58	x	73.59	x	0.63	x	0.7	=	58.02	(80)
West	0.9x	0.77	x	4.95	x	45.59	x	0.63	x	0.7	=	68.97	(80)
West	0.9x	0.77	x	2.58	x	45.59	x	0.63	x	0.7	=	35.95	(80)
West	0.9x	0.77	x	4.95	x	24.49	x	0.63	x	0.7	=	37.05	(80)
West	0.9x	0.77	x	2.58	x	24.49	x	0.63	x	0.7	=	19.31	(80)
West	0.9x	0.77	x	4.95	x	16.15	x	0.63	x	0.7	=	24.43	(80)
West	0.9x	0.77	x	2.58	x	16.15	x	0.63	x	0.7	=	12.73	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	189.65	324.99	446.96	552.96	615.18	607.98	587.37	541.97	484.15	360.08	227.58	161.99	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	606.45	739.75	848.4	932.87	973.23	944.95	910.61	871.11	824.31	721.97	614.46	567.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.78	0.6	0.44	0.48	0.71	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.84	20.05	20.34	20.65	20.87	20.97	20.99	20.99	20.94	20.64	20.17	19.8	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.91	19.92	19.92	19.93	19.93	19.94	19.94	19.94	19.94	19.93	19.93	19.92	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.87	0.72	0.51	0.34	0.37	0.63	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.39	18.7	19.11	19.55	19.81	19.93	19.94	19.94	19.89	19.54	18.89	18.33	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.97	19.24	19.6	19.99	20.24	20.34	20.36	20.36	20.31	19.98	19.4	18.92	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.97	19.24	19.6	19.99	20.24	20.34	20.36	20.36	20.31	19.98	19.4	18.92	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.98	0.94	0.87	0.74	0.55	0.38	0.42	0.66	0.9	0.98	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	600.37	721.82	801.25	813.77	720.12	518.15	346.7	363.43	543.66	650.4	601.08	563.32		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	1398.7	1364.61	1243.46	1040.13	799.05	532.17	348.57	366.35	577.71	878.3	1156.51	1390.2		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	593.96	431.95	329	162.98	58.73	0	0	0	0	169.56	399.91	615.19		
Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =													2761.29	(98)
Space heating requirement in kWh/m²/year													34.94	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	593.96	431.95	329	162.98	58.73	0	0	0	0	169.56	399.91	615.19		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	635.25	461.98	351.88	174.31	62.81	0	0	0	0	181.35	427.71	657.96		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2953.25	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	197.08	173.7	182.41	163.5	160.21	143.13	137.44	150.84	150.59	169.54	179.29	192.33		
Efficiency of water heater													79.8	(216)
(217)m=	87.57	87.15	86.37	84.81	82.41	79.8	79.8	79.8	79.8	84.81	86.89	87.7		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	225.04	199.31	211.2	192.79	194.4	179.36	172.23	189.03	188.71	199.89	206.34	219.31		
Total = Sum(219a)$_{1...12}$ =													2377.61	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2953.25

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Water heating fuel used			2377.61	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			342.28	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	637.9	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	513.56	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1151.47	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	177.64	(268)
Total CO2, kg/year		sum of (265)…(271) =		1368.03	(272)

TER = 17.31 (273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-2-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	105.24	(1a) x	2.4	(2a) =	252.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	105.24	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	252.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 5			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Floor			105.24	x	0.11	=	11.5764			(28)
Walls Type1	30.46	12.88	17.58	x	0.18	=	3.16			(29)
Walls Type2	29.12	2.1	27.02	x	0.18	=	4.86			(29)
Total area of elements, m²			164.82							(31)
Party wall			42.26	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 36.87 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.67 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 52.54 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.21	94.21	94.21	94.21	94.21	94.21	94.21	94.21	94.21	94.21	94.21	94.21	

Average = Sum(39)$_{1…12}$ /12= 94.21 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9

Average = Sum(40)$_{1…12}$ /12= 0.9 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.78 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 100.3 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	110.33	106.31	102.3	98.29	94.28	90.27	90.27	94.28	98.29	102.3	106.31	110.33

Total = Sum(44)$_{1…12}$ = 1203.56 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	163.61	143.1	147.66	128.73	123.52	106.59	98.77	113.34	114.7	133.67	145.91	158.45

Total = Sum(45)$_{1…12}$ = 1578.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.54	21.46	22.15	19.31	18.53	15.99	14.82	17	17.2	20.05	21.89	23.77	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	218.89	193.02	202.94	182.23	178.8	160.09	154.05	168.62	168.19	188.95	199.4	213.73	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	218.89	193.02	202.94	182.23	178.8	160.09	154.05	168.62	168.19	188.95	199.4	213.73

Output from water heater (annual)$_{1...12}$ — 2228.9 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	98.62	87.52	93.32	85.6	85.29	78.24	77.06	81.91	80.93	88.67	91.31	96.91	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.31	22.48	18.28	13.84	10.34	8.73	9.44	12.27	16.46	20.9	24.4	26.01	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	264.53	267.28	260.36	245.63	227.04	209.57	197.9	195.16	202.07	216.8	235.39	252.86	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	(71)

Water heating gains (Table 5)

(72)m=	132.56	130.24	125.43	118.89	114.64	108.66	103.58	110.09	112.41	119.18	126.82	130.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	487.14	484.74	468.81	443.1	416.77	391.71	375.66	382.26	395.69	421.62	451.35	473.86	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)

West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	70.12	137.17	225.91	329.47	403.78	413.34	393.52	338.02	262.74	162.77	87.43	57.67	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	557.26	621.91	694.72	772.58	820.55	805.05	769.18	720.28	658.43	584.39	538.79	531.53	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.89	0.71	0.53	0.59	0.86	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.05	20.16	20.37	20.63	20.86	20.97	21	20.99	20.92	20.62	20.28	20.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.96	0.85	0.64	0.44	0.49	0.79	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.88	19.05	19.35	19.73	20.03	20.15	20.17	20.17	20.1	19.72	19.22	18.84	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.23	19.38	19.65	20	20.28	20.4	20.42	20.42	20.35	19.99	19.54	19.19	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.23	19.38	19.65	20	20.28	20.4	20.42	20.42	20.35	19.99	19.54	19.19	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.95	0.85	0.66	0.47	0.52	0.81	0.97	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	556.15	619.25	686	737.43	700.8	529.22	357.92	374.92	532.06	568.2	536.37	530.73	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1406.98	1364.48	1239.29	1045.87	808.41	546.33	359.69	378.33	588.65	884.44	1171.73	1412.32	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	633.01	500.79	411.64	222.07	80.06	0	0	0	0	235.28	457.46	655.9	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3196.23 (98)

Space heating requirement in kWh/m²/year 30.37 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		3196.23	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	3356.04	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2228.9	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2340.35	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	56.96	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		68.1	(330a)

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warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =		68.1	(331)
Energy for lighting (calculated in Appendix L)			446.9	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1323.03	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	29.56	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1352.6	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1352.6	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	35.34	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	231.94	(379)
Total CO2, kg/year	sum of (376)…(382) =				1619.88	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				15.39	(384)
EI rating (section 14)					85.55	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-2-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	105.24	(1a) x	2.4	(2a) =	252.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	105.24	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	252.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.43	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 3			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 4			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 5			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Floor			105.24	x	0.13	=	13.6812			(28)
Walls Type1	30.46	12.88	17.58	x	0.18	=	3.16			(29)
Walls Type2	29.12	2.1	27.02	x	0.18	=	4.86			(29)
Total area of elements, m²			164.82							(31)
Party wall			42.26	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.88 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.9 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 56.78 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	49.84	49.52	49.21	47.75	47.48	46.21	46.21	45.97	46.7	47.48	48.03	48.61	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	106.62	106.3	105.99	104.53	104.26	102.99	102.99	102.76	103.48	104.26	104.81	105.39	

Average = $Sum(39)_{1...12}$ /12= 104.53 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.01	1.01	1.01	0.99	0.99	0.98	0.98	0.98	0.98	0.99	1	1	

Average = $Sum(40)_{1...12}$ /12= 0.99 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.78 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 100.3 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	110.33	106.31	102.3	98.29	94.28	90.27	90.27	94.28	98.29	102.3	106.31	110.33	

Total = $Sum(44)_{1...12}$ = 1203.56 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	163.61	143.1	147.66	128.73	123.52	106.59	98.77	113.34	114.7	133.67	145.91	158.45	

Total = $Sum(45)_{1...12}$ = 1578.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.54	21.46	22.15	19.31	18.53	15.99	14.82	17	17.2	20.05	21.89	23.77	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.21	185.18	194.26	173.83	170.12	151.68	145.37	159.94	159.79	180.26	191	205.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	210.21	185.18	194.26	173.83	170.12	151.68	145.37	159.94	159.79	180.26	191	205.04

Output from water heater (annual)1…12 | 2126.68 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.68	81.25	86.37	78.88	78.35	71.52	70.12	74.96	74.21	81.72	84.59	89.96	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	26.06	23.15	18.83	14.25	10.65	8.99	9.72	12.63	16.96	21.53	25.13	26.79	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	264.53	267.28	260.36	245.63	227.04	209.57	197.9	195.16	202.07	216.8	235.39	252.86	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	(71)

Water heating gains (Table 5)

(72)m=	123.22	120.9	116.09	109.55	105.31	99.33	94.24	100.76	103.07	109.84	117.48	120.91	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	481.56	479.07	463.02	437.18	410.75	385.64	369.61	376.29	389.84	415.91	445.75	468.31	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)

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West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	77.31	151.23	249.06	363.24	445.17	455.71	433.85	372.67	289.67	179.45	96.4	63.58	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	558.87	630.31	712.09	800.42	855.92	841.35	803.46	748.96	679.51	595.37	542.14	531.88	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.9	0.73	0.55	0.61	0.87	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.88	20.01	20.24	20.55	20.82	20.96	20.99	20.99	20.89	20.54	20.16	19.86	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.07	20.07	20.08	20.09	20.09	20.1	20.1	20.1	20.1	20.09	20.09	20.08	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.96	0.86	0.65	0.45	0.5	0.81	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.57	18.75	19.09	19.55	19.9	20.07	20.1	20.1	20	19.54	18.98	18.55	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.96	19.13	19.44	19.85	20.18	20.34	20.37	20.36	20.27	19.84	19.34	18.94	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(93)m=	18.96	19.13	19.44	19.85	20.18	20.34	20.37	20.36	20.27	19.84	19.34	18.94		(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	1	1	0.99	0.96	0.86	0.67	0.48	0.54	0.82	0.97	1	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	557.7	627.53	703.22	765.42	739.03	565.46	384.83	401.68	559.26	579.93	539.72	531.04		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	1563.15	1512.75	1371.18	1144.65	883.82	591.09	387.95	407.41	638.27	963.59	1282.47	1553.69		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	748.06	594.87	496.96	273.04	107.72	0	0	0	0	285.44	534.78	760.85		
Total per year (kWh/year) = Sum(98)1...5,9...12 =													3801.73	(98)
Space heating requirement in kWh/m²/year													36.12	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	748.06	594.87	496.96	273.04	107.72	0	0	0	0	285.44	534.78	760.85		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	800.06	636.22	531.51	292.02	115.21	0	0	0	0	305.29	571.96	813.75		
Total (kWh/year) =Sum(211)1...5,10...12=													4066.02	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)1...5,10...12=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)														
	210.21	185.18	194.26	173.83	170.12	151.68	145.37	159.94	159.79	180.26	191	205.04		
Efficiency of water heater													79.8	(216)
(217)m=	87.91	87.71	87.21	86.01	83.63	79.8	79.8	79.8	79.8	86.03	87.42	88		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	239.1	211.13	222.74	202.09	203.41	190.08	182.17	200.42	200.24	209.52	218.5	233.02		
Total = Sum(219a)1...12 =													2512.42	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		4066.02

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Water heating fuel used			2512.42	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			460.27	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	878.26	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	542.68	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1420.94	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	238.88	(268)
Total CO2, kg/year		sum of (265)…(271) =		1698.75	(272)

TER = 16.14 (273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-2-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.91	(1a) x	2.4	(2a) =	208.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.91	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	208.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 4			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 5			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Floor			86.91	x	0.11	=	9.560101			(28)
Walls Type1	47.44	17.25	30.19	x	0.18	=	5.43			(29)
Walls Type2	10.78	2.1	8.68	x	0.18	=	1.56			(29)
Total area of elements, m²			145.13							(31)
Party wall			48.43	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.83 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 17.58 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 56.41 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	90.82	90.82	90.82	90.82	90.82	90.82	90.82	90.82	90.82	90.82	90.82	90.82	

Average = Sum(39)$_{1...12}$ /12= 90.82 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	

Average = Sum(40)$_{1...12}$ /12= 1.05 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.58 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.5 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	105.05	101.23	97.41	93.59	89.77	85.95	85.95	89.77	93.59	97.41	101.23	105.05	

Total = Sum(44)$_{1...12}$ = 1145.99 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.78	136.25	140.6	122.58	117.62	101.49	94.05	107.92	109.21	127.27	138.93	150.87	

Total = Sum(45)$_{1...12}$ = 1502.57 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.37	20.44	21.09	18.39	17.64	15.22	14.11	16.19	16.38	19.09	20.84	22.63	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.06	186.18	195.88	176.07	172.89	154.99	149.33	163.2	162.7	182.55	192.42	206.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.06	186.18	195.88	176.07	172.89	154.99	149.33	163.2	162.7	182.55	192.42	206.15

Output from water heater (annual)$_{1...12}$ | 2153.41 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	96.02	85.25	90.97	83.55	83.33	76.54	75.49	80.11	79.11	86.54	88.99	94.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	20.79	18.47	15.02	11.37	8.5	7.18	7.75	10.08	13.53	17.18	20.05	21.37	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	233.28	235.7	229.6	216.61	200.22	184.81	174.52	172.1	178.2	191.18	207.58	222.98	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	(71)
Water heating gains (Table 5)													
(72)m=	129.06	126.85	122.27	116.04	112	106.31	101.47	107.67	109.87	116.32	123.6	126.86	(72)
Total internal gains =					(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m								
(73)m=	444.84	442.73	428.6	405.74	382.43	360.01	345.46	351.56	363.31	386.39	412.94	432.93	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)

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West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	80.71	157.17	260.4	387.27	484.5	501.1	474.91	400.76	304.85	186.61	100.42	66.55	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	525.55	599.91	689.01	793.01	866.93	861.11	820.37	752.32	668.16	573.01	513.36	499.48	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.83	0.65	0.48	0.54	0.82	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.91	20.05	20.3	20.62	20.87	20.97	21	20.99	20.91	20.57	20.17	19.87	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.78	0.56	0.38	0.44	0.74	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.58	18.79	19.15	19.6	19.92	20.03	20.04	20.04	19.98	19.55	18.97	18.53	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.11	19.29	19.61	20.01	20.3	20.41	20.42	20.42	20.35	19.96	19.45	19.06	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.11	19.29	19.61	20.01	20.3	20.41	20.42	20.42	20.35	19.96	19.45	19.06	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.8	0.6	0.42	0.48	0.77	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	523.6	595.15	673.67	734.67	691.06	512.48	345.49	361.54	513.37	549.18	509.34	498.05	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1345.4	1307.12	1190.67	1008.68	780.8	527.37	347.38	365.3	567.6	850.02	1121.86	1350.03	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	611.42	478.44	384.65	197.29	66.76	0	0	0	0	223.82	441.02	633.87	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3037.27 (98)

Space heating requirement in kWh/m²/year 34.95 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		3037.27	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	3189.14	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2153.41	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2261.09	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	54.5	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		56.24	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			56.24	(331)
Energy for lighting (calculated in Appendix L)				367.2	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1265.86	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	28.29	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1294.14	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1294.14	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	29.19	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	190.58	(379)
Total CO2, kg/year	sum of (376)…(382) =				1513.91	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17.42	(384)
EI rating (section 14)					84.62	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-2-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.91	(1a) x	2.4	(2a) =	208.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.91	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	208.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.39	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 4			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 5			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Floor			86.91	x	0.13	=	11.2983			(28)
Walls Type1	47.44	17.25	30.19	x	0.18	=	5.43			(29)
Walls Type2	10.78	2.1	8.68	x	0.18	=	1.56			(29)
Total area of elements, m²			145.13							(31)
Party wall			48.43	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 43.26 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 16.1 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 59.36 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.69	40.44	40.2	39.08	38.87	37.9	37.9	37.72	38.27	38.87	39.3	39.74	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	100.05	99.81	99.57	98.45	98.24	97.26	97.26	97.08	97.64	98.24	98.66	99.11	

Average = Sum(39)$_{1...12}$ /12= 98.45 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.15	1.15	1.15	1.13	1.13	1.12	1.12	1.12	1.12	1.13	1.14	1.14	

Average = Sum(40)$_{1...12}$ /12= 1.13 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.58 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.5 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	105.05	101.23	97.41	93.59	89.77	85.95	85.95	89.77	93.59	97.41	101.23	105.05	

Total = Sum(44)$_{1...12}$ = 1145.99 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.78	136.25	140.6	122.58	117.62	101.49	94.05	107.92	109.21	127.27	138.93	150.87	

Total = Sum(45)$_{1...12}$ = 1502.57 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.37	20.44	21.09	18.39	17.64	15.22	14.11	16.19	16.38	19.09	20.84	22.63	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.38	178.34	187.19	167.67	164.21	146.59	140.64	154.52	154.3	173.87	184.02	197.46	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.38	178.34	187.19	167.67	164.21	146.59	140.64	154.52	154.3	173.87	184.02	197.46

Output from water heater (annual)$_{1...12}$ — 2051.19 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.07	78.97	84.02	76.83	76.38	69.82	68.55	73.16	72.39	79.59	82.27	87.44	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.96	18.62	15.14	11.46	8.57	7.23	7.82	10.16	13.64	17.31	20.21	21.54	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	233.28	235.7	229.6	216.61	200.22	184.81	174.52	172.1	178.2	191.18	207.58	222.98	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	(71)

Water heating gains (Table 5)

(72)m=	119.72	117.52	112.94	106.71	102.67	96.97	92.13	98.33	100.54	106.98	114.26	117.53	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	438.68	436.55	422.39	399.5	376.17	353.73	339.18	345.31	357.09	380.2	406.76	426.77	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.29	x	10.63	x	0.63	x	0.7	=	17.19	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.63	x	0.7	=	32.85	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.63	x	0.7	=	55.82	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.63	x	0.7	=	89.67	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.63	x	0.7	=	120.79	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.63	x	0.7	=	129.31	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.63	x	0.7	=	120.73	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.63	x	0.7	=	95.78	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.63	x	0.7	=	67.12	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.63	x	0.7	=	39.11	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.63	x	0.7	=	21.21	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.63	x	0.7	=	14.33	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)

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West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	88.98	173.28	287.1	426.96	534.16	552.47	523.59	441.84	336.1	205.74	110.72	73.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	527.65	609.83	709.49	826.46	910.33	906.2	862.77	787.14	693.18	585.94	517.48	500.13	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.84	0.65	0.49	0.55	0.82	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.76	19.92	20.19	20.56	20.84	20.97	20.99	20.99	20.89	20.51	20.07	19.74	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.96	19.96	19.96	19.97	19.98	19.99	19.99	19.99	19.98	19.98	19.97	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.79	0.56	0.38	0.44	0.75	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.31	18.54	18.94	19.46	19.82	19.96	19.98	19.98	19.89	19.41	18.77	18.28	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.89	19.09	19.44	19.9	20.23	20.36	20.39	20.38	20.29	19.85	19.29	18.86	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(93)m=	18.89	19.09	19.44	19.9	20.23	20.36	20.39	20.38	20.29	19.85	19.29	18.86		(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	1	0.99	0.98	0.93	0.8	0.6	0.42	0.48	0.77	0.96	0.99	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	525.62	604.8	693.31	765.11	727.63	541.5	365.66	381.68	536.93	562.04	513.39	498.65		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	1460.04	1416.47	1288.74	1082.8	837.63	560.65	368.34	386.83	604.59	908.6	1202.94	1453.3		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	695.21	545.45	443	228.74	81.84	0	0	0	0	257.84	496.48	710.26		
Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =													3458.81	(98)
Space heating requirement in kWh/m²/year													39.8	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	695.21	545.45	443	228.74	81.84	0	0	0	0	257.84	496.48	710.26		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	743.54	583.36	473.79	244.64	87.53	0	0	0	0	275.76	530.99	759.64		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3699.26	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	202.38	178.34	187.19	167.67	164.21	146.59	140.64	154.52	154.3	173.87	184.02	197.46		
Efficiency of water heater													79.8	(216)
(217)m=	87.84	87.61	87.03	85.64	83.07	79.8	79.8	79.8	79.8	85.86	87.33	87.94		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	230.38	203.57	215.08	195.78	197.69	183.69	176.24	193.63	193.36	202.5	210.71	224.56		
Total = Sum(219a)$_{1...12}$ =													2427.19	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3699.26

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Water heating fuel used			2427.19	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			370.17	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	799.04	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	524.27	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1323.31	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	192.12	(268)
Total CO2, kg/year		sum of (265)…(271) =		1554.35	(272)
TER =				17.88	(273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-3-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.14	(1a) x	2.4	(2a) =	206.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.14	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	206.74	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 4			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 5			8.05	x1/[1/(1.2)+ 0.04]		=	9.22			(27)
Walls Type1	44.62	19.78	24.84	x	0.18	=	4.47			(29)
Walls Type2	5.87	2.1	3.77	x	0.18	=	0.68			(29)
Total area of elements, m²			50.49							(31)
Party wall			44.11	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.84 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 41.16 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	75.27	75.27	75.27	75.27	75.27	75.27	75.27	75.27	75.27	75.27	75.27	75.27	

Average = Sum(39)$_{1…12}$ /12= 75.27 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	

Average = Sum(40)$_{1…12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	104.74	100.93	97.12	93.31	89.5	85.69	85.69	89.5	93.31	97.12	100.93	104.74	

Total = Sum(44)$_{1…12}$ = 1142.6 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.32	135.85	140.18	122.21	117.27	101.19	93.77	107.6	108.89	126.9	138.52	150.42	

Total = Sum(45)$_{1…12}$ = 1498.13 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.3	20.38	21.03	18.33	17.59	15.18	14.07	16.14	16.33	19.03	20.78	22.56	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.6	185.77	195.46	175.71	172.54	154.69	149.05	162.88	162.38	182.17	192.01	205.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	210.6	185.77	195.46	175.71	172.54	154.69	149.05	162.88	162.38	182.17	192.01	205.7	

Output from water heater (annual)$_{1...12}$	2148.97	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	95.87	85.11	90.83	83.43	83.21	76.44	75.4	80	79	86.42	88.85	94.24	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.66	18.35	14.93	11.3	8.45	7.13	7.71	10.02	13.44	17.07	19.92	21.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	231.79	234.2	228.14	215.23	198.95	183.64	173.41	171	177.07	189.97	206.26	221.57	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	(71)

Water heating gains (Table 5)

(72)m=	128.85	126.65	122.09	115.88	111.85	106.17	101.34	107.53	109.72	116.15	123.41	126.66	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	442.85	440.74	426.69	403.95	380.78	358.47	344	350.08	361.77	384.73	411.12	431.01	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)

North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)

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North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
East	0.9x	1	x	8.05	x	19.64	x	0.5	x	0.8	=	43.83	(76)
East	0.9x	1	x	8.05	x	38.42	x	0.5	x	0.8	=	85.73	(76)
East	0.9x	1	x	8.05	x	63.27	x	0.5	x	0.8	=	141.19	(76)
East	0.9x	1	x	8.05	x	92.28	x	0.5	x	0.8	=	205.92	(76)
East	0.9x	1	x	8.05	x	113.09	x	0.5	x	0.8	=	252.36	(76)
East	0.9x	1	x	8.05	x	115.77	x	0.5	x	0.8	=	258.34	(76)
East	0.9x	1	x	8.05	x	110.22	x	0.5	x	0.8	=	245.95	(76)
East	0.9x	1	x	8.05	x	94.68	x	0.5	x	0.8	=	211.27	(76)
East	0.9x	1	x	8.05	x	73.59	x	0.5	x	0.8	=	164.21	(76)
East	0.9x	1	x	8.05	x	45.59	x	0.5	x	0.8	=	101.73	(76)
East	0.9x	1	x	8.05	x	24.49	x	0.5	x	0.8	=	54.65	(76)
East	0.9x	1	x	8.05	x	16.15	x	0.5	x	0.8	=	36.04	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	78.4	151.81	253.47	386.27	495.3	518.41	488.76	403.91	299.2	180.38	97.3	64.86	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.25	592.55	680.16	790.21	876.08	876.89	832.76	753.99	660.97	565.11	508.42	495.87	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.75	0.54	0.4	0.46	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.29	20.51	20.79	20.95	20.99	21	21	20.97	20.72	20.38	20.12	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.89	0.7	0.48	0.32	0.38	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.24	19.57	19.95	20.15	20.19	20.19	20.19	20.16	19.87	19.38	19	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.66	19.95	20.28	20.47	20.51	20.51	20.51	20.49	20.21	19.78	19.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.66	19.95	20.28	20.47	20.51	20.51	20.51	20.49	20.21	19.78	19.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.72	0.5	0.35	0.41	0.7	0.94	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	519.23	587.22	660.85	707.46	628.68	441.76	294.31	308.92	461.1	533.89	503.88	494.44	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1143.66	1111.07	1012.26	856.78	660	444.83	294.59	309.6	480.64	723.67	954.53	1147.6	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	464.57	352.03	261.45	107.51	23.3	0	0	0	0	141.2	324.47	485.95

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 2160.47 (98)

Space heating requirement in kWh/m²/year 25.08 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2160.47	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2268.49	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2148.97	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2256.41	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	45.25	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		55.74	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	55.74	(331)

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Energy for lighting (calculated in Appendix L)				364.94	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	= 1050.95	(367)
Electrical energy for heat distribution	[(313) x		0.52	= 23.48	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			= 1074.43	(373)
CO2 associated with space heating (secondary)	(309) x		0	= 0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	= 0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1074.43	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	= 28.93	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	= 189.41	(379)
Total CO2, kg/year	sum of (376)…(382) =			1292.77	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.01	(384)
EI rating (section 14)				86.79	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-3-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.14	(1a) x	2.4	(2a) =	206.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.14	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	206.74	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.71	x1/[1/(1.4)+ 0.04]		=	3.59			(27)
Windows Type 2			1.81	x1/[1/(1.4)+ 0.04]		=	2.4			(27)
Windows Type 3			1.81	x1/[1/(1.4)+ 0.04]		=	2.4			(27)
Windows Type 4			5.2	x1/[1/(1.4)+ 0.04]		=	6.89			(27)
Windows Type 5			7.91	x1/[1/(1.4)+ 0.04]		=	10.49			(27)
Walls Type1	44.62	19.44	25.18	x	0.18	=	4.53			(29)
Walls Type2	5.87	2.1	3.77	x	0.18	=	0.68			(29)
Total area of elements, m²			50.49							(31)
Party wall			44.11	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	33.08	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		4.76	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	37.85	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

TER WorkSheet: New dwelling design stage

(38)m=	40.37	40.12	39.89	38.77	38.56	37.58	37.58	37.4	37.96	38.56	38.98	39.42	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.21	77.97	77.73	76.62	76.41	75.43	75.43	75.25	75.81	76.41	76.83	77.27	

Average = Sum(39)$_{1…12}$ /12= 76.61 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.91	0.91	0.9	0.89	0.89	0.88	0.88	0.87	0.88	0.89	0.89	0.9	

Average = Sum(40)$_{1…12}$ /12= 0.89 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	104.74	100.93	97.12	93.31	89.5	85.69	85.69	89.5	93.31	97.12	100.93	104.74	

Total = Sum(44)$_{1…12}$ = 1142.6 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.32	135.85	140.18	122.21	117.27	101.19	93.77	107.6	108.89	126.9	138.52	150.42	

Total = Sum(45)$_{1…12}$ = 1498.13 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.3	20.38	21.03	18.33	17.59	15.18	14.07	16.14	16.33	19.03	20.78	22.56	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.92	177.93	186.78	167.31	163.86	146.28	140.36	154.2	153.98	173.49	183.61	197.02	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.92	177.93	186.78	167.31	163.86	146.28	140.36	154.2	153.98	173.49	183.61	197.02	

Output from water heater (annual)$_{1...12}$	2046.74	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	88.92	78.84	83.89	76.71	76.27	69.72	68.45	73.05	72.28	79.47	82.13	87.29	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.66	18.35	14.92	11.3	8.45	7.13	7.7	10.01	13.44	17.07	19.92	21.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	231.79	234.2	228.14	215.23	198.95	183.64	173.41	171	177.07	189.97	206.26	221.57	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	(71)

Water heating gains (Table 5)

(72)m=	119.52	117.32	112.75	106.54	102.51	96.83	92.01	98.19	100.39	106.81	114.07	117.33	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	436.51	434.41	420.35	397.61	374.44	352.14	337.66	343.75	355.43	378.39	404.79	424.67	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.71	x	10.63	x	0.63	x	0.7	=	8.81	(74)
North	0.9x	0.77	x	1.81	x	10.63	x	0.63	x	0.7	=	5.88	(74)

North	0.9x	0.77	x	1.81	x	10.63	x	0.63	x	0.7	=	5.88	(74)
North	0.9x	0.77	x	5.2	x	10.63	x	0.63	x	0.7	=	16.9	(74)
North	0.9x	0.77	x	2.71	x	20.32	x	0.63	x	0.7	=	16.83	(74)
North	0.9x	0.77	x	1.81	x	20.32	x	0.63	x	0.7	=	11.24	(74)
North	0.9x	0.77	x	1.81	x	20.32	x	0.63	x	0.7	=	11.24	(74)
North	0.9x	0.77	x	5.2	x	20.32	x	0.63	x	0.7	=	32.29	(74)
North	0.9x	0.77	x	2.71	x	34.53	x	0.63	x	0.7	=	28.6	(74)
North	0.9x	0.77	x	1.81	x	34.53	x	0.63	x	0.7	=	19.1	(74)
North	0.9x	0.77	x	1.81	x	34.53	x	0.63	x	0.7	=	19.1	(74)
North	0.9x	0.77	x	5.2	x	34.53	x	0.63	x	0.7	=	54.88	(74)
North	0.9x	0.77	x	2.71	x	55.46	x	0.63	x	0.7	=	45.94	(74)
North	0.9x	0.77	x	1.81	x	55.46	x	0.63	x	0.7	=	30.68	(74)
North	0.9x	0.77	x	1.81	x	55.46	x	0.63	x	0.7	=	30.68	(74)
North	0.9x	0.77	x	5.2	x	55.46	x	0.63	x	0.7	=	88.14	(74)
North	0.9x	0.77	x	2.71	x	74.72	x	0.63	x	0.7	=	61.88	(74)
North	0.9x	0.77	x	1.81	x	74.72	x	0.63	x	0.7	=	41.33	(74)
North	0.9x	0.77	x	1.81	x	74.72	x	0.63	x	0.7	=	41.33	(74)
North	0.9x	0.77	x	5.2	x	74.72	x	0.63	x	0.7	=	118.74	(74)
North	0.9x	0.77	x	2.71	x	79.99	x	0.63	x	0.7	=	66.24	(74)
North	0.9x	0.77	x	1.81	x	79.99	x	0.63	x	0.7	=	44.24	(74)
North	0.9x	0.77	x	1.81	x	79.99	x	0.63	x	0.7	=	44.24	(74)
North	0.9x	0.77	x	5.2	x	79.99	x	0.63	x	0.7	=	127.11	(74)
North	0.9x	0.77	x	2.71	x	74.68	x	0.63	x	0.7	=	61.85	(74)
North	0.9x	0.77	x	1.81	x	74.68	x	0.63	x	0.7	=	41.31	(74)
North	0.9x	0.77	x	1.81	x	74.68	x	0.63	x	0.7	=	41.31	(74)
North	0.9x	0.77	x	5.2	x	74.68	x	0.63	x	0.7	=	118.68	(74)
North	0.9x	0.77	x	2.71	x	59.25	x	0.63	x	0.7	=	49.07	(74)
North	0.9x	0.77	x	1.81	x	59.25	x	0.63	x	0.7	=	32.77	(74)
North	0.9x	0.77	x	1.81	x	59.25	x	0.63	x	0.7	=	32.77	(74)
North	0.9x	0.77	x	5.2	x	59.25	x	0.63	x	0.7	=	94.15	(74)
North	0.9x	0.77	x	2.71	x	41.52	x	0.63	x	0.7	=	34.38	(74)
North	0.9x	0.77	x	1.81	x	41.52	x	0.63	x	0.7	=	22.97	(74)
North	0.9x	0.77	x	1.81	x	41.52	x	0.63	x	0.7	=	22.97	(74)
North	0.9x	0.77	x	5.2	x	41.52	x	0.63	x	0.7	=	65.98	(74)
North	0.9x	0.77	x	2.71	x	24.19	x	0.63	x	0.7	=	20.03	(74)
North	0.9x	0.77	x	1.81	x	24.19	x	0.63	x	0.7	=	13.38	(74)
North	0.9x	0.77	x	1.81	x	24.19	x	0.63	x	0.7	=	13.38	(74)
North	0.9x	0.77	x	5.2	x	24.19	x	0.63	x	0.7	=	38.44	(74)
North	0.9x	0.77	x	2.71	x	13.12	x	0.63	x	0.7	=	10.86	(74)
North	0.9x	0.77	x	1.81	x	13.12	x	0.63	x	0.7	=	7.26	(74)
North	0.9x	0.77	x	1.81	x	13.12	x	0.63	x	0.7	=	7.26	(74)

North	0.9x	0.77	x	5.2	x	13.12	x	0.63	x	0.7	=	20.85	(74)
North	0.9x	0.77	x	2.71	x	8.86	x	0.63	x	0.7	=	7.34	(74)
North	0.9x	0.77	x	1.81	x	8.86	x	0.63	x	0.7	=	4.9	(74)
North	0.9x	0.77	x	1.81	x	8.86	x	0.63	x	0.7	=	4.9	(74)
North	0.9x	0.77	x	5.2	x	8.86	x	0.63	x	0.7	=	14.09	(74)
East	0.9x	1	x	7.91	x	19.64	x	0.63	x	0.7	=	47.48	(76)
East	0.9x	1	x	7.91	x	38.42	x	0.63	x	0.7	=	92.88	(76)
East	0.9x	1	x	7.91	x	63.27	x	0.63	x	0.7	=	152.96	(76)
East	0.9x	1	x	7.91	x	92.28	x	0.63	x	0.7	=	223.08	(76)
East	0.9x	1	x	7.91	x	113.09	x	0.63	x	0.7	=	273.39	(76)
East	0.9x	1	x	7.91	x	115.77	x	0.63	x	0.7	=	279.86	(76)
East	0.9x	1	x	7.91	x	110.22	x	0.63	x	0.7	=	266.44	(76)
East	0.9x	1	x	7.91	x	94.68	x	0.63	x	0.7	=	228.87	(76)
East	0.9x	1	x	7.91	x	73.59	x	0.63	x	0.7	=	177.89	(76)
East	0.9x	1	x	7.91	x	45.59	x	0.63	x	0.7	=	110.21	(76)
East	0.9x	1	x	7.91	x	24.49	x	0.63	x	0.7	=	59.2	(76)
East	0.9x	1	x	7.91	x	16.15	x	0.63	x	0.7	=	39.04	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	84.95	164.48	274.63	418.52	536.67	561.71	529.58	437.64	324.19	195.44	105.42	70.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.46	598.89	694.98	816.13	911.11	913.85	867.24	781.38	679.62	573.83	510.21	494.95	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.74	0.52	0.38	0.44	0.73	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.1	20.25	20.49	20.79	20.95	21	21	21	20.97	20.72	20.36	20.08	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.16	20.17	20.18	20.18	20.19	20.19	20.19	20.18	20.18	20.17	20.17	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.46	0.31	0.36	0.66	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.96	19.17	19.52	19.94	20.14	20.19	20.19	20.19	20.16	19.86	19.34	18.93	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.42	19.6	19.91	20.28	20.46	20.51	20.51	20.51	20.48	20.2	19.75	19.39	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.42	19.6	19.91	20.28	20.46	20.51	20.51	20.51	20.48	20.2	19.75	19.39	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.89	0.7	0.49	0.34	0.4	0.69	0.94	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	519.47	593.43	674.54	724.67	640.32	443.23	294.92	308.98	465.79	541.19	505.67	493.54	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1182.27	1146.13	1042.26	871.77	669.64	445.75	295.14	309.53	483.96	733.74	971.69	1173.85	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	493.12	371.41	273.59	105.91	21.82	0	0	0	0	143.26	335.53	506.14

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2250.79 (98)

Space heating requirement in kWh/m²/year 26.13 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	493.12	371.41	273.59	105.91	21.82	0	0	0	0	143.26	335.53	506.14	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	527.4	397.23	292.61	113.28	23.33	0	0	0	0	153.22	358.86	541.33	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2407.27 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

201.92	177.93	186.78	167.31	163.86	146.28	140.36	154.2	153.98	173.49	183.61	197.02

Efficiency of water heater 79.8 (216)

(217)m=	87.11	86.73	85.83	83.63	80.92	79.8	79.8	79.8	79.8	84.31	86.4	87.22	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	231.81	205.15	217.61	200.05	202.49	183.31	175.9	193.23	192.96	205.78	212.51	225.88

Total = Sum(219a)$_{1...12}$ = 2446.67 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2407.27
Water heating fuel used		2446.67
Electricity for pumps, fans and electric keep-hot		

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central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			364.88	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	519.97	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	528.48	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1048.45	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.37	(268)
Total CO2, kg/year		sum of (265)…(271) =		1276.75	(272)

TER = 14.82 (273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-3-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.42	(1a) x	2.4	(2a) =	171.41	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		171.41	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Walls Type1	28.74	10.12	18.62	x	0.18	=	3.35			(29)
Walls Type2	43.06	2.1	40.96	x	0.18	=	7.37			(29)
Total area of elements, m²			71.8							(31)
Party wall			14.79	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 24.83 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.38 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 35.21 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	63.49	63.49	63.49	63.49	63.49	63.49	63.49	63.49	63.49	63.49	63.49	63.49	

Average = Sum(39)$_{1…12}$ /12= 63.49 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89

Average = Sum(40)$_{1...12}$ /12= 0.89 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.28 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	97.19	93.65	90.12	86.59	83.05	79.52	79.52	83.05	86.59	90.12	93.65	97.19	

Total = Sum(44)$_{1...12}$ = 1060.23 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.13	126.05	130.08	113.4	108.81	93.9	87.01	99.85	101.04	117.75	128.53	139.58

Total = Sum(45)$_{1...12}$ = 1390.13 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.62	18.91	19.51	17.01	16.32	14.08	13.05	14.98	15.16	17.66	19.28	20.94	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.4	175.98	185.35	166.9	164.09	147.39	142.29	155.12	154.53	173.03	182.03	194.86	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.4	175.98	185.35	166.9	164.09	147.39	142.29	155.12	154.53	173.03	182.03	194.86	

Output from water heater (annual)$_{1...12}$ 2040.97 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.14	81.85	87.47	80.5	80.4	74.02	73.15	77.42	76.39	83.37	85.53	90.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	114	114	114	114	114	114	114	114	114	114	114	114	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	18.61	16.53	13.44	10.18	7.61	6.42	6.94	9.02	12.11	15.37	17.94	19.13	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	200.59	202.67	197.42	186.26	172.16	158.91	150.06	147.98	153.23	164.39	178.49	191.74	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	(71)
Water heating gains (Table 5)													
(72)m=	123.85	121.81	117.57	111.81	108.07	102.8	98.32	104.06	106.1	112.06	118.79	121.82	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	400.25	398.21	385.64	365.45	345.04	325.34	312.53	318.26	328.64	349.03	372.43	389.89	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x 1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x 1	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(76)
East	0.9x 1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x 1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)

East	0.9x	1	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	55.1	107.78	177.5	258.87	317.25	324.77	309.19	265.59	206.44	127.89	68.7	45.31	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	455.35	505.99	563.14	624.32	662.29	650.11	621.72	583.86	535.07	476.92	441.13	435.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.81	0.61	0.45	0.5	0.76	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.28	20.49	20.74	20.92	20.99	21	21	20.96	20.72	20.39	20.13	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.91	0.76	0.54	0.36	0.41	0.69	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.06	19.23	19.53	19.88	20.1	20.17	20.18	20.18	20.15	19.86	19.38	19	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.5	19.65	19.92	20.23	20.43	20.5	20.51	20.5	20.47	20.2	19.78	19.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.5	19.65	19.92	20.23	20.43	20.5	20.51	20.5	20.47	20.2	19.78	19.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.77	0.57	0.4	0.44	0.72	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	453.07	500.84	547.73	570.77	512.96	369.15	247.46	259.64	384.44	449.66	436.31	433.52	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	965.02	936.61	851.8	719.16	554.42	374.42	247.96	260.6	404.5	609.65	805.33	968.45	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	380.89	292.84	226.23	106.84	30.85	0	0	0	0	119.03	265.7	397.99	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1820.37 (98)

Space heating requirement in kWh/m²/year 25.49 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.
Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers 1 (303a)

Fraction of total space heat from Community boilers (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 1820.37

Space heat from Community boilers (98) x (304a) x (305) x (306) = 1911.38 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308

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Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2040.97	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2143.01	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	40.54	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.22	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	46.22	(331)
Energy for lighting (calculated in Appendix L)		328.7	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	941.67	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	21.04	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	962.71	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				962.71	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	23.99	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	170.6	(379)

Total CO2, kg/year	sum of (376)…(382) =	1157.29	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =	16.2	(384)
EI rating (section 14)		86.68	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-3-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	71.42	(1a)	x	2.4	(2a)	=	171.41	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.42	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	171.41	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.43	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Walls Type1	28.74	10.12	18.62	x	0.18	=	3.35			(29)
Walls Type2	43.06	2.1	40.96	x	0.18	=	7.37			(29)
Total area of elements, m²			71.8							(31)
Party wall			14.79	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 26.24 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.21 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 32.45 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.28	34.05	33.82	32.75	32.55	31.61	31.61	31.44	31.97	32.55	32.95	33.38	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	66.73	66.5	66.27	65.2	65	64.06	64.06	63.89	64.42	65	65.41	65.83	

Average = Sum(39)$_{1…12}$ /12= 65.2 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.91	0.91	0.9	0.9	0.89	0.9	0.91	0.92	0.92

Average = Sum(40)1…12 /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.28 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.19	93.65	90.12	86.59	83.05	79.52	79.52	83.05	86.59	90.12	93.65	97.19

Total = Sum(44)1…12 = 1060.23 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.13	126.05	130.08	113.4	108.81	93.9	87.01	99.85	101.04	117.75	128.53	139.58

Total = Sum(45)1…12 = 1390.13 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.62	18.91	19.51	17.01	16.32	14.08	13.05	14.98	15.16	17.66	19.28	20.94	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	190.72	168.14	176.67	158.5	155.41	138.99	133.61	146.44	146.13	164.34	173.63	186.17	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	190.72	168.14	176.67	158.5	155.41	138.99	133.61	146.44	146.13	164.34	173.63	186.17	

Output from water heater (annual)$_{1...12}$ 1938.74 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.2	75.58	80.53	73.78	73.46	67.29	66.21	70.47	69.67	76.43	78.81	83.69	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114	114	114	114	114	114	114	114	114	114	114	114	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.13	17	13.82	10.46	7.82	6.6	7.14	9.27	12.45	15.81	18.45	19.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.59	202.67	197.42	186.26	172.16	158.91	150.06	147.98	153.23	164.39	178.49	191.74	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	(71)

Water heating gains (Table 5)

(72)m=	114.51	112.47	108.23	102.47	98.73	93.46	88.99	94.72	96.76	102.73	109.46	112.48	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	394.44	392.34	379.68	359.4	338.92	319.18	306.39	312.18	322.64	343.13	366.6	384.09	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)

East	0.9x	1	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	60.74	118.83	195.69	285.4	349.77	358.06	340.88	292.81	227.6	141	75.74	49.95	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	455.18	511.17	575.37	644.8	688.69	677.24	647.27	605	550.24	484.13	442.34	434.04	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.8	0.59	0.43	0.48	0.75	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.1	20.23	20.46	20.74	20.92	20.99	21	21	20.96	20.71	20.35	20.08	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.16	20.16	20.17	20.17	20.17	20.17	20.16	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.75	0.52	0.35	0.4	0.68	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.93	19.12	19.45	19.86	20.09	20.16	20.17	20.17	20.14	19.83	19.32	18.91	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.57	19.86	20.21	20.42	20.49	20.5	20.5	20.46	20.18	19.73	19.38	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.57	19.86	20.21	20.42	20.49	20.5	20.5	20.46	20.18	19.73	19.38	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.91	0.76	0.55	0.39	0.43	0.71	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	452.97	505.98	559.32	586.3	525.94	372.95	249.49	261.22	390.43	456.14	437.61	432.41	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1007.38	975.34	885.09	737.42	566.94	377.59	249.93	262.07	410.05	622.63	826.26	999.04	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	412.48	315.42	242.38	108.8	30.5	0	0	0	0	123.87	279.83	421.57	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1934.85 | (98)

Space heating requirement in kWh/m²/year | 27.09 | (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	412.48	315.42	242.38	108.8	30.5	0	0	0	0	123.87	279.83	421.57	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	441.16	337.34	259.23	116.37	32.62	0	0	0	0	132.48	299.28	450.88	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= | 2069.36 | (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= | 0 | (215)

TER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

190.72	168.14	176.67	158.5	155.41	138.99	133.61	146.44	146.13	164.34	173.63	186.17

Efficiency of water heater 79.8 (216)

(217)m=	86.82	86.47	85.66	83.83	81.38	79.8	79.8	79.8	79.8	84.07	86.08	86.93	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	219.68	194.45	206.25	189.06	190.97	174.17	167.42	183.51	183.12	195.48	201.7	214.17

Total = Sum(219a)$_{1...12}$ = 2319.98 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2069.36	
Water heating fuel used			2319.98	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			337.92	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	446.98	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	501.12	(264)
Space and water heating	(261) + (262) + (263) + (264) =			948.1	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	175.38	(268)
Total CO2, kg/year		sum of (265)…(271) =		1162.41	(272)

TER = 16.28 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-3-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.01	(1a) x	2.4	(2a) =	127.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.01	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	127.22	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	37.55	11.96	25.59	x	0.18	=	4.61			(29)
Walls Type2	25.99	2.1	23.89	x	0.18	=	4.3			(29)
Total area of elements, m²			63.54							(31)
Party wall			14.75	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.12 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.89 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 35.01 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	56	56	56	56	56	56	56	56	56	56	56	56	

Average = Sum(39)$_{1…12}$ /12= 56 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06

Average = Sum(40)$_{1...12}$ /12= 1.06 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.78 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 76.45 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	84.09	81.03	77.98	74.92	71.86	68.8	68.8	71.86	74.92	77.98	81.03	84.09	

Total = Sum(44)$_{1...12}$ = 917.37 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	124.71	109.07	112.55	98.12	94.15	81.25	75.29	86.39	87.42	101.88	111.21	120.77

Total = Sum(45)$_{1...12}$ = 1202.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.71	16.36	16.88	14.72	14.12	12.19	11.29	12.96	13.11	15.28	16.68	18.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.98	159	167.83	151.62	149.43	134.74	130.56	141.67	140.92	157.16	164.71	176.05	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.98	159	167.83	151.62	149.43	134.74	130.56	141.67	140.92	157.16	164.71	176.05	

Output from water heater (annual)$_{1...12}$ 1853.66 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.69	76.21	81.64	75.42	75.53	69.81	69.25	72.95	71.86	78.1	79.77	84.38	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.82	12.28	9.98	7.56	5.65	4.77	5.15	6.7	8.99	11.42	13.33	14.21	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	155.04	156.65	152.6	143.97	133.07	122.83	115.99	114.38	118.44	127.07	137.96	148.2	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	(71)

Water heating gains (Table 5)

(72)m=	115.17	113.4	109.74	104.75	101.51	96.96	93.08	98.05	99.81	104.97	110.8	113.41	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	333.72	332.02	322	305.96	289.92	274.24	263.91	268.81	276.92	293.14	311.77	325.5	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)

East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)

South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	113.51	195.48	270.93	337.99	378.11	374.49	361.47	332.12	294.49	217.19	136.4	96.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	447.23	527.49	592.93	643.95	668.03	648.73	625.38	600.93	571.41	510.33	448.17	422.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.86	0.72	0.54	0.39	0.43	0.65	0.89	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.3	20.54	20.78	20.93	20.99	21	21	20.97	20.77	20.39	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.83	0.66	0.47	0.31	0.34	0.57	0.86	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.88	19.15	19.49	19.8	19.98	20.03	20.04	20.04	20.02	19.8	19.27	18.8	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.73	20.01	20.29	20.45	20.51	20.52	20.52	20.49	20.28	19.83	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.73	20.01	20.29	20.45	20.51	20.52	20.52	20.49	20.28	19.83	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.97	0.93	0.84	0.69	0.5	0.35	0.38	0.61	0.87	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	440.47	509.77	549.21	540.49	461.62	326.52	218.87	229.72	346.67	442.87	433.74	417.43	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	850.93	830.3	756.89	637.94	490.28	330.91	219.38	230.54	358.04	542.38	712.89	852.93	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	305.39	215.4	154.52	70.17	21.32	0	0	0	0	74.03	200.99	324.01	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1365.84 (98)

Space heating requirement in kWh/m²/year 25.77 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1365.84	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1434.13	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1853.66	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1946.34	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	33.8	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		34.3	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	34.3	(331)
Energy for lighting (calculated in Appendix L)		244.11	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	785.14	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	17.54	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	802.69	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				802.69	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	17.8	(378)

CO2 associated with electricity for lighting		(332))) x	0.52	=	126.69	(379)
Total CO2, kg/year	sum of (376)…(382) =				947.18	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17.87	(384)
EI rating (section 14)					87.05	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-3-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.01	(1a) x	2.4	(2a) =	127.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.01	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	127.22	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.29	x1/[1/(1.4)+ 0.04]		=	5.69			(27)
Windows Type 2			2.57	x1/[1/(1.4)+ 0.04]		=	3.41			(27)
Windows Type 3			2.57	x1/[1/(1.4)+ 0.04]		=	3.41			(27)
Windows Type 4			1.72	x1/[1/(1.4)+ 0.04]		=	2.28			(27)
Walls Type1	37.55	11.15	26.4	x	0.18	=	4.75			(29)
Walls Type2	25.99	2.1	23.89	x	0.18	=	4.3			(29)
Total area of elements, m²			63.54							(31)
Party wall			14.75	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.93 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.08 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 32.02 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.08	24.92	24.77	24.03	23.9	23.26	23.26	23.14	23.51	23.9	24.17	24.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	57.1	56.94	56.78	56.05	55.91	55.28	55.28	55.16	55.52	55.91	56.19	56.48	

Average = Sum(39)$_{1…12}$ /12= 56.05 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.08	1.07	1.07	1.06	1.05	1.04	1.04	1.04	1.05	1.05	1.06	1.07

Average = Sum(40)$_{1…12}$ /12= 1.06 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.78 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 76.45 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	84.09	81.03	77.98	74.92	71.86	68.8	68.8	71.86	74.92	77.98	81.03	84.09	
											Total = Sum(44)$_{1…12}$ =	917.37	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	124.71	109.07	112.55	98.12	94.15	81.25	75.29	86.39	87.42	101.88	111.21	120.77	
											Total = Sum(45)$_{1…12}$ =	1202.82	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.71	16.36	16.88	14.72	14.12	12.19	11.29	12.96	13.11	15.28	16.68	18.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	171.3	151.16	159.14	143.22	140.75	126.34	121.88	132.99	132.52	148.48	156.31	167.37	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	171.3	151.16	159.14	143.22	140.75	126.34	121.88	132.99	132.52	148.48	156.31	167.37	

Output from water heater (annual)$_{1...12}$ 1751.44 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	78.74	69.93	74.7	68.7	68.58	63.09	62.31	66	65.14	71.15	73.05	77.43	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.86	12.31	10.01	7.58	5.67	4.78	5.17	6.72	9.02	11.45	13.36	14.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	155.04	156.65	152.6	143.97	133.07	122.83	115.99	114.38	118.44	127.07	137.96	148.2	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	(71)

Water heating gains (Table 5)

(72)m=	105.83	104.07	100.4	95.42	92.18	87.62	83.75	88.71	90.47	95.64	101.46	104.08	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	327.42	325.71	315.69	299.64	283.6	267.92	257.59	262.49	270.61	286.83	305.47	319.21	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.57	x	19.64	x	0.63	x	0.7	=	15.43	(76)
East	0.9x	1	x	2.57	x	19.64	x	0.63	x	0.7	=	15.43	(76)
East	0.9x	1	x	2.57	x	38.42	x	0.63	x	0.7	=	30.18	(76)
East	0.9x	1	x	2.57	x	38.42	x	0.63	x	0.7	=	30.18	(76)
East	0.9x	1	x	2.57	x	63.27	x	0.63	x	0.7	=	49.7	(76)

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East	0.9x	1	x	2.57	x	63.27	x	0.63	x	0.7	=	49.7	(76)
East	0.9x	1	x	2.57	x	92.28	x	0.63	x	0.7	=	72.48	(76)
East	0.9x	1	x	2.57	x	92.28	x	0.63	x	0.7	=	72.48	(76)
East	0.9x	1	x	2.57	x	113.09	x	0.63	x	0.7	=	88.83	(76)
East	0.9x	1	x	2.57	x	113.09	x	0.63	x	0.7	=	88.83	(76)
East	0.9x	1	x	2.57	x	115.77	x	0.63	x	0.7	=	90.93	(76)
East	0.9x	1	x	2.57	x	115.77	x	0.63	x	0.7	=	90.93	(76)
East	0.9x	1	x	2.57	x	110.22	x	0.63	x	0.7	=	86.57	(76)
East	0.9x	1	x	2.57	x	110.22	x	0.63	x	0.7	=	86.57	(76)
East	0.9x	1	x	2.57	x	94.68	x	0.63	x	0.7	=	74.36	(76)
East	0.9x	1	x	2.57	x	94.68	x	0.63	x	0.7	=	74.36	(76)
East	0.9x	1	x	2.57	x	73.59	x	0.63	x	0.7	=	57.8	(76)
East	0.9x	1	x	2.57	x	73.59	x	0.63	x	0.7	=	57.8	(76)
East	0.9x	1	x	2.57	x	45.59	x	0.63	x	0.7	=	35.81	(76)
East	0.9x	1	x	2.57	x	45.59	x	0.63	x	0.7	=	35.81	(76)
East	0.9x	1	x	2.57	x	24.49	x	0.63	x	0.7	=	19.23	(76)
East	0.9x	1	x	2.57	x	24.49	x	0.63	x	0.7	=	19.23	(76)
East	0.9x	1	x	2.57	x	16.15	x	0.63	x	0.7	=	12.69	(76)
East	0.9x	1	x	2.57	x	16.15	x	0.63	x	0.7	=	12.69	(76)
South	0.9x	0.77	x	4.29	x	46.75	x	0.63	x	0.7	=	61.3	(78)
South	0.9x	0.77	x	1.72	x	46.75	x	0.63	x	0.7	=	24.58	(78)
South	0.9x	0.77	x	4.29	x	76.57	x	0.63	x	0.7	=	100.39	(78)
South	0.9x	0.77	x	1.72	x	76.57	x	0.63	x	0.7	=	40.25	(78)
South	0.9x	0.77	x	4.29	x	97.53	x	0.63	x	0.7	=	127.87	(78)
South	0.9x	0.77	x	1.72	x	97.53	x	0.63	x	0.7	=	51.27	(78)
South	0.9x	0.77	x	4.29	x	110.23	x	0.63	x	0.7	=	144.53	(78)
South	0.9x	0.77	x	1.72	x	110.23	x	0.63	x	0.7	=	57.95	(78)
South	0.9x	0.77	x	4.29	x	114.87	x	0.63	x	0.7	=	150.61	(78)
South	0.9x	0.77	x	1.72	x	114.87	x	0.63	x	0.7	=	60.38	(78)
South	0.9x	0.77	x	4.29	x	110.55	x	0.63	x	0.7	=	144.94	(78)
South	0.9x	0.77	x	1.72	x	110.55	x	0.63	x	0.7	=	58.11	(78)
South	0.9x	0.77	x	4.29	x	108.01	x	0.63	x	0.7	=	141.61	(78)
South	0.9x	0.77	x	1.72	x	108.01	x	0.63	x	0.7	=	56.78	(78)
South	0.9x	0.77	x	4.29	x	104.89	x	0.63	x	0.7	=	137.53	(78)
South	0.9x	0.77	x	1.72	x	104.89	x	0.63	x	0.7	=	55.14	(78)
South	0.9x	0.77	x	4.29	x	101.89	x	0.63	x	0.7	=	133.58	(78)
South	0.9x	0.77	x	1.72	x	101.89	x	0.63	x	0.7	=	53.56	(78)
South	0.9x	0.77	x	4.29	x	82.59	x	0.63	x	0.7	=	108.28	(78)
South	0.9x	0.77	x	1.72	x	82.59	x	0.63	x	0.7	=	43.41	(78)
South	0.9x	0.77	x	4.29	x	55.42	x	0.63	x	0.7	=	72.66	(78)
South	0.9x	0.77	x	1.72	x	55.42	x	0.63	x	0.7	=	29.13	(78)

South	0.9x	0.77	x	4.29	x	40.4	x	0.63	x	0.7	=	52.97	(78)
South	0.9x	0.77	x	1.72	x	40.4	x	0.63	x	0.7	=	21.24	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	116.72	200.99	278.54	347.43	388.64	384.91	371.53	341.39	302.73	223.3	140.26	99.57	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	444.14	526.7	594.23	647.07	672.24	652.82	629.12	603.88	573.34	510.13	445.72	418.78	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.86	0.72	0.53	0.39	0.42	0.64	0.89	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.08	20.28	20.53	20.78	20.93	20.99	21	21	20.97	20.77	20.38	20.04	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.02	20.02	20.02	20.04	20.04	20.05	20.05	20.05	20.04	20.04	20.03	20.03	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.83	0.66	0.46	0.3	0.33	0.56	0.86	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.81	19.1	19.45	19.8	19.98	20.04	20.05	20.05	20.02	19.8	19.26	18.77	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.45	19.69	19.99	20.29	20.46	20.52	20.52	20.52	20.5	20.29	19.82	19.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.45	19.69	19.99	20.29	20.46	20.52	20.52	20.52	20.5	20.29	19.82	19.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.93	0.84	0.69	0.5	0.34	0.38	0.6	0.87	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	437.72	509.48	551.08	541.99	461.87	323.15	216.42	226.75	344.68	442.59	431.72	414.11	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	864.76	842.07	766.07	638.57	489.64	326.99	216.85	227.44	355.27	541.6	714.65	858.71	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	317.72	223.5	159.95	69.54	20.66	0	0	0	0	73.67	203.71	330.78	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 1399.53 (98)

Space heating requirement in kWh/m²/year 26.4 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	317.72	223.5	159.95	69.54	20.66	0	0	0	0	73.67	203.71	330.78		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	339.8	239.03	171.07	74.38	22.1	0	0	0	0	78.79	217.87	353.78		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1496.82	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	171.3	151.16	159.14	143.22	140.75	126.34	121.88	132.99	132.52	148.48	156.31	167.37		
Efficiency of water heater													79.8	(216)
(217)m=	86.44	85.86	84.83	83.01	81.03	79.8	79.8	79.8	79.8	83.06	85.52	86.6		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	198.17	176.06	187.61	172.53	173.71	158.32	152.73	166.65	166.06	178.77	182.77	193.27		
Total = Sum(219a)$_{1...12}$ =													2106.65	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1496.82	
Water heating fuel used			2106.65	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			244.75	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	323.31	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	455.04	(264)
Space and water heating	(261) + (262) + (263) + (264) =				778.35	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	127.02	(268)

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Total CO2, kg/year	sum of (265)…(271) =	944.3	(272)
TER =		17.81	(273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-3-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	79.03	(1a)	x	2.4	(2a)	=	189.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.03	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			189.67	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 5			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Walls Type1	42.8	18.86	23.94	x	0.18	=	4.31			(29)
Walls Type2	13.9	2.1	11.8	x	0.18	=	2.12			(29)
Total area of elements, m²			56.7							(31)
Party wall			39.79	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.55 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.96 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 41.51 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	

Average = $Sum(39)_{1...12}$ /12= 72.8 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	

Average = $Sum(40)_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.44 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.25 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	101.47	97.78	94.09	90.4	86.71	83.02	83.02	86.71	90.4	94.09	97.78	101.47	

Total = $Sum(44)_{1...12}$ = 1107 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150.48	131.61	135.81	118.41	113.61	98.04	90.85	104.25	105.49	122.94	134.2	145.74	

Total = $Sum(45)_{1...12}$ = 1451.45 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.57	19.74	20.37	17.76	17.04	14.71	13.63	15.64	15.82	18.44	20.13	21.86	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.76	181.54	191.09	171.9	168.89	151.53	146.13	159.53	158.99	178.22	187.7	201.01	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.76	181.54	191.09	171.9	168.89	151.53	146.13	159.53	158.99	178.22	187.7	201.01

Output from water heater (annual)1…12 | 2102.29 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	94.26	83.7	89.38	82.16	82	75.39	74.43	78.88	77.87	85.1	87.42	92.68	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	19.38	17.21	14	10.6	7.92	6.69	7.23	9.39	12.61	16.01	18.69	19.92	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	217.4	219.66	213.97	201.87	186.59	172.23	162.64	160.39	166.07	178.17	193.45	207.81	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	(71)
Water heating gains (Table 5)													
(72)m=	126.69	124.56	120.13	114.12	110.21	104.71	100.04	106.03	108.16	114.38	121.41	124.57	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	423.14	421.09	407.77	386.25	364.39	343.3	329.57	335.47	346.5	368.23	393.21	411.96	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)

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South	0.9x	0.77	x	5.29	x	46.75	x	0.5	x	0.8	=	68.56	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	5.29	x	76.57	x	0.5	x	0.8	=	112.28	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	5.29	x	97.53	x	0.5	x	0.8	=	143.02	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	5.29	x	110.23	x	0.5	x	0.8	=	161.65	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	5.29	x	114.87	x	0.5	x	0.8	=	168.45	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	5.29	x	110.55	x	0.5	x	0.8	=	162.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	5.29	x	108.01	x	0.5	x	0.8	=	158.39	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	5.29	x	104.89	x	0.5	x	0.8	=	153.82	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	5.29	x	101.89	x	0.5	x	0.8	=	149.4	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	5.29	x	82.59	x	0.5	x	0.8	=	121.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	5.29	x	55.42	x	0.5	x	0.8	=	81.26	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	5.29	x	40.4	x	0.5	x	0.8	=	59.24	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)

West	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	183.92	315.17	433.45	536.24	596.58	589.6	569.61	525.59	469.52	349.2	220.71	157.09	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	607.06	736.27	841.22	922.49	960.97	932.9	899.18	861.06	816.01	717.43	613.92	569.06	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.84	0.68	0.5	0.36	0.39	0.6	0.88	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.24	20.44	20.67	20.87	20.97	21	21	21	20.99	20.84	20.49	20.19	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.8	0.62	0.43	0.29	0.32	0.53	0.84	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.15	19.43	19.75	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.51	19.07	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.58	19.83	20.12	20.35	20.46	20.49	20.49	20.49	20.48	20.33	19.9	19.51	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.58	19.83	20.12	20.35	20.46	20.49	20.49	20.49	20.48	20.33	19.9	19.51	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.81	0.64	0.46	0.31	0.35	0.56	0.85	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	599.79	712	772.01	747.93	618.51	426.4	282.98	297.38	457.58	611.34	596.03	564.17	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1112.65	1087.2	991.25	833.57	637.72	428.55	283.16	297.71	464.41	708.33	932.04	1114.93	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	381.57	252.14	163.12	61.66	14.29	0	0	0	0	72.16	241.92	409.77

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1596.62 (98)

Space heating requirement in kWh/m²/year 20.2 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1596.62	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1676.45	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating Annual water heating requirement		2102.29	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2207.4	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	38.84	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		51.14	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	51.14	(331)

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Energy for lighting (calculated in Appendix L)				342.28	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	902.06	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	20.16	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	922.21	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				922.21	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	26.54	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	177.64	(379)
Total CO2, kg/year	sum of (376)…(382) =				1126.4	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.25	(384)
EI rating (section 14)					87.83	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-3-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	79.03	(1a) x	2.4	(2a) =	189.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.03	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	189.67	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.43	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.58	x1/[1/(1.4)+ 0.04]		=	3.42			(27)
Windows Type 2			2.58	x1/[1/(1.4)+ 0.04]		=	3.42			(27)
Windows Type 3			2.58	x1/[1/(1.4)+ 0.04]		=	3.42			(27)
Windows Type 4			4.95	x1/[1/(1.4)+ 0.04]		=	6.56			(27)
Windows Type 5			4.95	x1/[1/(1.4)+ 0.04]		=	6.56			(27)
Walls Type1	42.8	17.64	25.16	x	0.18	=	4.53			(29)
Walls Type2	13.9	2.1	11.8	x	0.18	=	2.12			(29)
Total area of elements, m²			56.7							(31)
Party wall			39.79	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.14 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.58 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 37.72 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	37.42	37.18	36.95	35.85	35.65	34.7	34.7	34.52	35.06	35.65	36.06	36.5	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	75.14	74.9	74.67	73.57	73.37	72.41	72.41	72.24	72.78	73.37	73.78	74.22	

Average = Sum(39)$_{1...12}$ /12= 73.57 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.94	0.93	0.93	0.92	0.92	0.91	0.92	0.93	0.93	0.94

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.44 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	101.47	97.78	94.09	90.4	86.71	83.02	83.02	86.71	90.4	94.09	97.78	101.47

Total = Sum(44)$_{1...12}$ = 1107 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150.48	131.61	135.81	118.41	113.61	98.04	90.85	104.25	105.49	122.94	134.2	145.74

Total = Sum(45)$_{1...12}$ = 1451.45 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.57	19.74	20.37	17.76	17.04	14.71	13.63	15.64	15.82	18.44	20.13	21.86	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	197.08	173.7	182.41	163.5	160.21	143.13	137.44	150.84	150.59	169.54	179.29	192.33	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	197.08	173.7	182.41	163.5	160.21	143.13	137.44	150.84	150.59	169.54	179.29	192.33

Output from water heater (annual)$_{1...12}$ | 2000.06 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	87.31	77.43	82.43	75.44	75.05	68.67	67.48	71.94	71.15	78.15	80.7	85.73	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	19.38	17.21	14	10.6	7.92	6.69	7.23	9.39	12.61	16.01	18.69	19.92	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	217.4	219.66	213.97	201.87	186.59	172.23	162.64	160.39	166.07	178.17	193.45	207.81	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	(71)
Water heating gains (Table 5)													
(72)m=	117.35	115.22	110.8	104.78	100.88	95.38	90.7	96.69	98.82	105.05	112.08	115.23	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	416.8	414.76	401.43	379.91	358.05	336.96	323.23	329.14	340.16	361.89	386.88	405.62	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	2.58	x	46.75	x	0.63	x	0.7	=	36.86	(78)
South	0.9x	0.77	x	2.58	x	46.75	x	0.63	x	0.7	=	36.86	(78)

South	0.9x	0.77	x	4.95	x	46.75	x	0.63	x	0.7	=	70.73	(78)
South	0.9x	0.77	x	2.58	x	76.57	x	0.63	x	0.7	=	60.37	(78)
South	0.9x	0.77	x	2.58	x	76.57	x	0.63	x	0.7	=	60.37	(78)
South	0.9x	0.77	x	4.95	x	76.57	x	0.63	x	0.7	=	115.83	(78)
South	0.9x	0.77	x	2.58	x	97.53	x	0.63	x	0.7	=	76.9	(78)
South	0.9x	0.77	x	2.58	x	97.53	x	0.63	x	0.7	=	76.9	(78)
South	0.9x	0.77	x	4.95	x	97.53	x	0.63	x	0.7	=	147.55	(78)
South	0.9x	0.77	x	2.58	x	110.23	x	0.63	x	0.7	=	86.92	(78)
South	0.9x	0.77	x	2.58	x	110.23	x	0.63	x	0.7	=	86.92	(78)
South	0.9x	0.77	x	4.95	x	110.23	x	0.63	x	0.7	=	166.76	(78)
South	0.9x	0.77	x	2.58	x	114.87	x	0.63	x	0.7	=	90.57	(78)
South	0.9x	0.77	x	2.58	x	114.87	x	0.63	x	0.7	=	90.57	(78)
South	0.9x	0.77	x	4.95	x	114.87	x	0.63	x	0.7	=	173.78	(78)
South	0.9x	0.77	x	2.58	x	110.55	x	0.63	x	0.7	=	87.16	(78)
South	0.9x	0.77	x	2.58	x	110.55	x	0.63	x	0.7	=	87.16	(78)
South	0.9x	0.77	x	4.95	x	110.55	x	0.63	x	0.7	=	167.23	(78)
South	0.9x	0.77	x	2.58	x	108.01	x	0.63	x	0.7	=	85.17	(78)
South	0.9x	0.77	x	2.58	x	108.01	x	0.63	x	0.7	=	85.17	(78)
South	0.9x	0.77	x	4.95	x	108.01	x	0.63	x	0.7	=	163.4	(78)
South	0.9x	0.77	x	2.58	x	104.89	x	0.63	x	0.7	=	82.71	(78)
South	0.9x	0.77	x	2.58	x	104.89	x	0.63	x	0.7	=	82.71	(78)
South	0.9x	0.77	x	4.95	x	104.89	x	0.63	x	0.7	=	158.68	(78)
South	0.9x	0.77	x	2.58	x	101.89	x	0.63	x	0.7	=	80.33	(78)
South	0.9x	0.77	x	2.58	x	101.89	x	0.63	x	0.7	=	80.33	(78)
South	0.9x	0.77	x	4.95	x	101.89	x	0.63	x	0.7	=	154.13	(78)
South	0.9x	0.77	x	2.58	x	82.59	x	0.63	x	0.7	=	65.12	(78)
South	0.9x	0.77	x	2.58	x	82.59	x	0.63	x	0.7	=	65.12	(78)
South	0.9x	0.77	x	4.95	x	82.59	x	0.63	x	0.7	=	124.93	(78)
South	0.9x	0.77	x	2.58	x	55.42	x	0.63	x	0.7	=	43.7	(78)
South	0.9x	0.77	x	2.58	x	55.42	x	0.63	x	0.7	=	43.7	(78)
South	0.9x	0.77	x	4.95	x	55.42	x	0.63	x	0.7	=	83.83	(78)
South	0.9x	0.77	x	2.58	x	40.4	x	0.63	x	0.7	=	31.85	(78)
South	0.9x	0.77	x	2.58	x	40.4	x	0.63	x	0.7	=	31.85	(78)
South	0.9x	0.77	x	4.95	x	40.4	x	0.63	x	0.7	=	61.11	(78)
West	0.9x	0.77	x	2.58	x	19.64	x	0.63	x	0.7	=	15.49	(80)
West	0.9x	0.77	x	4.95	x	19.64	x	0.63	x	0.7	=	29.71	(80)
West	0.9x	0.77	x	2.58	x	38.42	x	0.63	x	0.7	=	30.29	(80)
West	0.9x	0.77	x	4.95	x	38.42	x	0.63	x	0.7	=	58.12	(80)
West	0.9x	0.77	x	2.58	x	63.27	x	0.63	x	0.7	=	49.89	(80)
West	0.9x	0.77	x	4.95	x	63.27	x	0.63	x	0.7	=	95.72	(80)
West	0.9x	0.77	x	2.58	x	92.28	x	0.63	x	0.7	=	72.76	(80)

West	0.9x	0.77	x	4.95	x	92.28	x	0.63	x	0.7	=	139.6	(80)
West	0.9x	0.77	x	2.58	x	113.09	x	0.63	x	0.7	=	89.17	(80)
West	0.9x	0.77	x	4.95	x	113.09	x	0.63	x	0.7	=	171.08	(80)
West	0.9x	0.77	x	2.58	x	115.77	x	0.63	x	0.7	=	91.28	(80)
West	0.9x	0.77	x	4.95	x	115.77	x	0.63	x	0.7	=	175.14	(80)
West	0.9x	0.77	x	2.58	x	110.22	x	0.63	x	0.7	=	86.91	(80)
West	0.9x	0.77	x	4.95	x	110.22	x	0.63	x	0.7	=	166.74	(80)
West	0.9x	0.77	x	2.58	x	94.68	x	0.63	x	0.7	=	74.65	(80)
West	0.9x	0.77	x	4.95	x	94.68	x	0.63	x	0.7	=	143.22	(80)
West	0.9x	0.77	x	2.58	x	73.59	x	0.63	x	0.7	=	58.02	(80)
West	0.9x	0.77	x	4.95	x	73.59	x	0.63	x	0.7	=	111.32	(80)
West	0.9x	0.77	x	2.58	x	45.59	x	0.63	x	0.7	=	35.95	(80)
West	0.9x	0.77	x	4.95	x	45.59	x	0.63	x	0.7	=	68.97	(80)
West	0.9x	0.77	x	2.58	x	24.49	x	0.63	x	0.7	=	19.31	(80)
West	0.9x	0.77	x	4.95	x	24.49	x	0.63	x	0.7	=	37.05	(80)
West	0.9x	0.77	x	2.58	x	16.15	x	0.63	x	0.7	=	12.73	(80)
West	0.9x	0.77	x	4.95	x	16.15	x	0.63	x	0.7	=	24.43	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	189.65	324.99	446.96	552.96	615.18	607.98	587.37	541.97	484.15	360.08	227.58	161.99	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	606.45	739.75	848.4	932.87	973.23	944.95	910.61	871.11	824.31	721.97	614.46	567.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.84	0.67	0.49	0.35	0.38	0.6	0.88	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.2	20.4	20.64	20.86	20.97	21	21	21	20.99	20.84	20.48	20.16	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.16	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.8	0.62	0.42	0.28	0.31	0.53	0.84	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.06	19.36	19.7	20	20.11	20.15	20.15	20.16	20.14	19.98	19.48	19.01	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.52	19.78	20.08	20.34	20.46	20.49	20.49	20.49	20.48	20.32	19.88	19.47	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.52	19.78	20.08	20.34	20.46	20.49	20.49	20.49	20.48	20.32	19.88	19.47	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.81	0.64	0.45	0.31	0.34	0.56	0.85	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	599.47	716.04	780.01	754.84	623.18	424.56	281.67	295.38	457.82	614.9	596.88	562.88	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1143.24	1114.53	1013.89	841.86	642.39	426.46	281.83	295.66	464.32	713.38	942.84	1133.37	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	404.57	267.78	174.01	62.65	14.29	0	0	0	0	73.27	249.09	424.45

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1670.12 (98)

Space heating requirement in kWh/m²/year 21.13 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	404.57	267.78	174.01	62.65	14.29	0	0	0	0	73.27	249.09	424.45	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	432.69	286.4	186.11	67.01	15.29	0	0	0	0	78.36	266.41	453.95	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1786.22 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

197.08	173.7	182.41	163.5	160.21	143.13	137.44	150.84	150.59	169.54	179.29	192.33

Efficiency of water heater 79.8 (216)

(217)m=	86.69	85.96	84.69	82.5	80.58	79.8	79.8	79.8	79.8	82.75	85.69	86.87	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	227.33	202.06	215.39	198.17	198.82	179.36	172.23	189.03	188.71	204.88	209.23	221.41

Total = Sum(219a)$_{1...12}$ = 2406.62 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1786.22
Water heating fuel used		2406.62
Electricity for pumps, fans and electric keep-hot		

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central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			342.28	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	385.82	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	519.83	(264)
Space and water heating	(261) + (262) + (263) + (264) =			905.65	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	177.64	(268)
Total CO2, kg/year		sum of (265)…(271) =		1122.22	(272)

TER = 14.2 (273)

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User Details:

Assessor Name: **Stroma Number:**
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.8

Property Address: b1-3-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	105.24	(1a) x	2.4	(2a) =	252.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	105.24	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	252.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 5			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Walls Type1	30.46	12.88	17.58	x	0.18	=	3.16			(29)
Walls Type2	29.12	2.1	27.02	x	0.18	=	4.86			(29)
Total area of elements, m²			59.58							(31)
Party wall			42.26	x	0	=	0			(32)

* *for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

** *include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	25.3	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		11.14	(36)
if details of thermal bridging are not known (36) = 0.15 x (31)			
Total fabric heat loss	(33) + (36) =	36.43	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.11	78.11	78.11	78.11	78.11	78.11	78.11	78.11	78.11	78.11	78.11	78.11	

Average = Sum(39)$_{1...12}$ /12= 78.11 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	

Average = Sum(40)$_{1...12}$ /12= 0.74 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.78 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 100.3 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	110.33	106.31	102.3	98.29	94.28	90.27	90.27	94.28	98.29	102.3	106.31	110.33	

Total = Sum(44)$_{1...12}$ = 1203.56 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	163.61	143.1	147.66	128.73	123.52	106.59	98.77	113.34	114.7	133.67	145.91	158.45	

Total = Sum(45)$_{1...12}$ = 1578.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.54	21.46	22.15	19.31	18.53	15.99	14.82	17	17.2	20.05	21.89	23.77	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	218.89	193.02	202.94	182.23	178.8	160.09	154.05	168.62	168.19	188.95	199.4	213.73	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	218.89	193.02	202.94	182.23	178.8	160.09	154.05	168.62	168.19	188.95	199.4	213.73

Output from water heater (annual)$_{1...12}$	2228.9	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	98.62	87.52	93.32	85.6	85.29	78.24	77.06	81.91	80.93	88.67	91.31	96.91	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.31	22.48	18.28	13.84	10.34	8.73	9.44	12.27	16.46	20.9	24.4	26.01	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	264.53	267.28	260.36	245.63	227.04	209.57	197.9	195.16	202.07	216.8	235.39	252.86	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	(71)

Water heating gains (Table 5)

(72)m=	132.56	130.24	125.43	118.89	114.64	108.66	103.58	110.09	112.41	119.18	126.82	130.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	487.14	484.74	468.81	443.1	416.77	391.71	375.66	382.26	395.69	421.62	451.35	473.86	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)

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West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)

West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	70.12	137.17	225.91	329.47	403.78	413.34	393.52	338.02	262.74	162.77	87.43	57.67	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	557.26	621.91	694.72	772.58	820.55	805.05	769.18	720.28	658.43	584.39	538.79	531.53	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.82	0.61	0.45	0.5	0.78	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.28	20.39	20.57	20.79	20.95	20.99	21	21	20.97	20.76	20.47	20.25	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.98	0.93	0.78	0.55	0.38	0.42	0.71	0.96	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.32	19.48	19.75	20.06	20.25	20.3	20.3	20.3	20.28	20.03	19.6	19.28	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.61	19.75	19.99	20.28	20.46	20.51	20.51	20.51	20.49	20.25	19.86	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.61	19.75	19.99	20.28	20.46	20.51	20.51	20.51	20.49	20.25	19.86	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

Useful gains, hmGm , W = (94)m x (84)m

Monthly average external temperature from Table 8

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(94)m=	1	0.99	0.98	0.93	0.79	0.57	0.4	0.45	0.73	0.96	0.99	1	(94)
(95)m=	556.08	618.73	682.74	719.13	644.99	457.92	305.35	320.65	480.96	560.63	535.89	530.71	(95)
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
(97)m=	1195.88	1159.99	1054	889.01	684.36	461.46	305.58	321.17	499.06	753.55	997.03	1200.37	(97)
(98)m=	476.02	363.73	276.22	122.31	29.29	0	0	0	0	143.53	332.02	498.23	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2241.34 (98)

Space heating requirement in kWh/m²/year 21.3 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2241.34	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2353.41	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2228.9	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2340.35	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	46.94	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		68.1	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	68.1	(331)

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Energy for lighting (calculated in Appendix L)				446.9	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22 =	1090.16	(367)
Electrical energy for heat distribution	[(313) x		0.52 =	24.36	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1114.52	(373)
CO2 associated with space heating (secondary)	(309) x		0 =	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22 =	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1114.52	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52 =	35.34	(378)
CO2 associated with electricity for lighting	(332))) x		0.52 =	231.94	(379)
Total CO2, kg/year	sum of (376)…(382) =			1381.81	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			13.13	(384)
EI rating (section 14)				87.68	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-3-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	105.24	(1a)	x	2.4	(2a)	=	252.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	105.24	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			252.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.43	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 4			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 5			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Walls Type1	30.46	12.88	17.58	x	0.18	=	3.16			(29)
Walls Type2	29.12	2.1	27.02	x	0.18	=	4.86			(29)
Total area of elements, m²			59.58							(31)
Party wall			42.26	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 27.2 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.51 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 32.71 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	49.84	49.52	49.21	47.75	47.48	46.21	46.21	45.97	46.7	47.48	48.03	48.61	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	82.55	82.23	81.92	80.46	80.19	78.92	78.92	78.68	79.41	80.19	80.74	81.32	

Average = Sum(39)$_{1\ldots12}$ /12= 80.46 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.78	0.78	0.78	0.76	0.76	0.75	0.75	0.75	0.75	0.76	0.77	0.77	

Average = Sum(40)$_{1\ldots12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.78 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 100.3 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	110.33	106.31	102.3	98.29	94.28	90.27	90.27	94.28	98.29	102.3	106.31	110.33

Total = Sum(44)$_{1\ldots12}$ = 1203.56 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	163.61	143.1	147.66	128.73	123.52	106.59	98.77	113.34	114.7	133.67	145.91	158.45

Total = Sum(45)$_{1\ldots12}$ = 1578.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.54	21.46	22.15	19.31	18.53	15.99	14.82	17	17.2	20.05	21.89	23.77	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.21	185.18	194.26	173.83	170.12	151.68	145.37	159.94	159.79	180.26	191	205.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	210.21	185.18	194.26	173.83	170.12	151.68	145.37	159.94	159.79	180.26	191	205.04

Output from water heater (annual)$_{1...12}$ 2126.68 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.68	81.25	86.37	78.88	78.35	71.52	70.12	74.96	74.21	81.72	84.59	89.96	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	26.06	23.15	18.83	14.25	10.65	8.99	9.72	12.63	16.96	21.53	25.13	26.79	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	264.53	267.28	260.36	245.63	227.04	209.57	197.9	195.16	202.07	216.8	235.39	252.86	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	(71)
Water heating gains (Table 5)													
(72)m=	123.22	120.9	116.09	109.55	105.31	99.33	94.24	100.76	103.07	109.84	117.48	120.91	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	481.56	479.07	463.02	437.18	410.75	385.64	369.61	376.29	389.84	415.91	445.75	468.31	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)

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West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)

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West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	77.31	151.23	249.06	363.24	445.17	455.71	433.85	372.67	289.67	179.45	96.4	63.58	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	558.87	630.31	712.09	800.42	855.92	841.35	803.46	748.96	679.51	595.37	542.14	531.88	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.94	0.81	0.59	0.43	0.48	0.77	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.22	20.33	20.54	20.79	20.95	20.99	21	21	20.97	20.75	20.44	20.2	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.27	20.27	20.27	20.28	20.29	20.3	20.3	20.3	20.29	20.29	20.28	20.28	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.98	0.93	0.76	0.53	0.36	0.41	0.7	0.96	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.2	19.38	19.67	20.04	20.24	20.29	20.3	20.3	20.27	20	19.54	19.19	(90)

fLA = Living area ÷ (4) = | 0.3 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.51	19.67	19.93	20.26	20.45	20.5	20.51	20.51	20.48	20.22	19.81	19.49	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.51	19.67	19.93	20.26	20.45	20.5	20.51	20.51	20.48	20.22	19.81	19.49	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.93	0.77	0.55	0.38	0.43	0.72	0.96	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	557.7	627.06	699.47	741.13	662.9	462.91	308.18	322.84	489.32	570.63	539.26	531.08	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1255.27	1214.15	1100.37	914.39	701.69	465.93	308.38	323.28	506.83	771.79	1026.53	1243.47	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	518.99	394.53	298.27	124.75	28.86	0	0	0	0	149.66	350.84	530.02

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2395.91 (98)

Space heating requirement in kWh/m²/year 22.77 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	518.99	394.53	298.27	124.75	28.86	0	0	0	0	149.66	350.84	530.02	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	555.06	421.95	319.01	133.42	30.87	0	0	0	0	160.06	375.23	566.87	(211)

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2562.47 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

210.21	185.18	194.26	173.83	170.12	151.68	145.37	159.94	159.79	180.26	191	205.04

Efficiency of water heater 79.8 (216)

(217)m=	87.13	86.78	85.95	83.95	81.19	79.8	79.8	79.8	79.8	84.32	86.42	87.24	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	241.25	213.38	226	207.07	209.53	190.08	182.17	200.42	200.24	213.78	221.03	235.04

Total = Sum(219a)$_{1...12}$ = 2539.98 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2562.47
Water heating fuel used		2539.98
Electricity for pumps, fans and electric keep-hot		

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central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			460.27	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	553.49	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	548.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1102.13	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	238.88	(268)
Total CO2, kg/year			sum of (265)…(271) =		1379.94	(272)

TER = 13.11 (273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-3-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.91	(1a) x	2.4	(2a) =	208.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.91	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	208.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 4			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 5			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Walls Type1	47.44	17.25	30.19	x	0.18	=	5.43			(29)
Walls Type2	10.78	2.1	8.68	x	0.18	=	1.56			(29)
Total area of elements, m²			58.22							(31)
Party wall			48.43	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 29.27 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.85 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 42.12 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.54	76.54	76.54	76.54	76.54	76.54	76.54	76.54	76.54	76.54	76.54	76.54	

Average = Sum(39)$_{1…12}$ /12= 76.54 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	

Average = Sum(40)$_{1…12}$ /12= 0.88 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.58 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.5 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	105.05	101.23	97.41	93.59	89.77	85.95	85.95	89.77	93.59	97.41	101.23	105.05

Total = Sum(44)$_{1…12}$ = 1145.99 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.78	136.25	140.6	122.58	117.62	101.49	94.05	107.92	109.21	127.27	138.93	150.87

Total = Sum(45)$_{1…12}$ = 1502.57 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.37	20.44	21.09	18.39	17.64	15.22	14.11	16.19	16.38	19.09	20.84	22.63	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.06	186.18	195.88	176.07	172.89	154.99	149.33	163.2	162.7	182.55	192.42	206.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.06	186.18	195.88	176.07	172.89	154.99	149.33	163.2	162.7	182.55	192.42	206.15	

Output from water heater (annual)$_{1...12}$ | 2153.41 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	96.02	85.25	90.97	83.55	83.33	76.54	75.49	80.11	79.11	86.54	88.99	94.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.79	18.47	15.02	11.37	8.5	7.18	7.75	10.08	13.53	17.18	20.05	21.37	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	233.28	235.7	229.6	216.61	200.22	184.81	174.52	172.1	178.2	191.18	207.58	222.98	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	(71)

Water heating gains (Table 5)

(72)m=	129.06	126.85	122.27	116.04	112	106.31	101.47	107.67	109.87	116.32	123.6	126.86	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	444.84	442.73	428.6	405.74	382.43	360.01	345.46	351.56	363.31	386.39	412.94	432.93	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)

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North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)

West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	80.71	157.17	260.4	387.27	484.5	501.1	474.91	400.76	304.85	186.61	100.42	66.55	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	525.55	599.91	689.01	793.01	866.93	861.11	820.37	752.32	668.16	573.01	513.36	499.48	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.76	0.56	0.41	0.47	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.14	20.28	20.51	20.78	20.94	20.99	21	21	20.96	20.72	20.37	20.11	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.71	0.49	0.33	0.38	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.03	19.23	19.56	19.93	20.13	20.18	20.18	20.18	20.16	19.86	19.37	18.98	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.48	19.65	19.94	20.27	20.46	20.5	20.51	20.51	20.48	20.21	19.77	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.48	19.65	19.94	20.27	20.46	20.5	20.51	20.51	20.48	20.21	19.77	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.73	0.52	0.36	0.42	0.7	0.94	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	523.53	594.47	669.39	712.75	634.34	448.1	298.9	313.73	467.74	541.23	508.79	498.05	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1161.61	1128.77	1028.45	870.09	670.31	451.94	299.25	314.51	488.34	735.26	969.56	1165.57	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	474.73	359.05	267.14	113.28	26.76	0	0	0	0	144.35	331.75	496.63

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2213.7 (98)

Space heating requirement in kWh/m²/year 25.47 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2213.7	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2324.39	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2153.41	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2261.09	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	45.85	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		56.24	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	56.24	(331)

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Energy for lighting (calculated in Appendix L)				367.2	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1065.01	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	23.8	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1088.81	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1088.81	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	29.19	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	190.58	(379)
Total CO2, kg/year	sum of (376)…(382) =				1308.58	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				15.06	(384)
EI rating (section 14)					86.71	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-3-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.91	(1a) x	2.4	(2a) =	208.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.91	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		208.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.39	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 4			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 5			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Walls Type1	47.44	17.25	30.19	x	0.18	=	5.43			(29)
Walls Type2	10.78	2.1	8.68	x	0.18	=	1.56			(29)
Total area of elements, m²			58.22							(31)
Party wall			48.43	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.97 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.48 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 37.45 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	40.69	40.44	40.2	39.08	38.87	37.9	37.9	37.72	38.27	38.87	39.3	39.74	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.13	77.89	77.65	76.53	76.32	75.35	75.35	75.16	75.72	76.32	76.75	77.19	

Average = $\mathrm{Sum}(39)_{1...12}$ /12= 76.53 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.9	0.9	0.89	0.88	0.88	0.87	0.87	0.86	0.87	0.88	0.88	0.89	

Average = $\mathrm{Sum}(40)_{1...12}$ /12= 0.88 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.58 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.5 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	105.05	101.23	97.41	93.59	89.77	85.95	85.95	89.77	93.59	97.41	101.23	105.05

Total = $\mathrm{Sum}(44)_{1...12}$ = 1145.99 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.78	136.25	140.6	122.58	117.62	101.49	94.05	107.92	109.21	127.27	138.93	150.87

Total = $\mathrm{Sum}(45)_{1...12}$ = 1502.57 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.37	20.44	21.09	18.39	17.64	15.22	14.11	16.19	16.38	19.09	20.84	22.63	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.38	178.34	187.19	167.67	164.21	146.59	140.64	154.52	154.3	173.87	184.02	197.46	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.38	178.34	187.19	167.67	164.21	146.59	140.64	154.52	154.3	173.87	184.02	197.46

Output from water heater (annual)$_{1...12}$ | 2051.19 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.07	78.97	84.02	76.83	76.38	69.82	68.55	73.16	72.39	79.59	82.27	87.44	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.96	18.62	15.14	11.46	8.57	7.23	7.82	10.16	13.64	17.31	20.21	21.54	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	233.28	235.7	229.6	216.61	200.22	184.81	174.52	172.1	178.2	191.18	207.58	222.98	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	(71)

Water heating gains (Table 5)

(72)m=	119.72	117.52	112.94	106.71	102.67	96.97	92.13	98.33	100.54	106.98	114.26	117.53	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	438.68	436.55	422.39	399.5	376.17	353.73	339.18	345.31	357.09	380.2	406.76	426.77	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.29	x	10.63	x	0.63	x	0.7	=	17.19	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.63	x	0.7	=	32.85	(74)

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North	0.9x	0.77	x	5.29	x	34.53	x	0.63	x	0.7	=	55.82	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.63	x	0.7	=	89.67	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.63	x	0.7	=	120.79	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.63	x	0.7	=	129.31	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.63	x	0.7	=	120.73	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.63	x	0.7	=	95.78	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.63	x	0.7	=	67.12	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.63	x	0.7	=	39.11	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.63	x	0.7	=	21.21	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.63	x	0.7	=	14.33	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)

West	0.9x	0.77	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	88.98	173.28	287.1	426.96	534.16	552.47	523.59	441.84	336.1	205.74	110.72	73.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	527.65	609.83	709.49	826.46	910.33	906.2	862.77	787.14	693.18	585.94	517.48	500.13	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.74	0.53	0.38	0.44	0.72	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.12	20.27	20.51	20.8	20.96	21	21	21	20.97	20.73	20.37	20.1	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.17	20.18	20.19	20.2	20.2	20.2	20.19	20.19	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.46	0.31	0.36	0.65	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.98	19.2	19.55	19.96	20.15	20.19	20.2	20.2	20.17	19.88	19.37	18.96	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.63	19.94	20.29	20.47	20.51	20.52	20.52	20.49	20.22	19.77	19.41	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.63	19.94	20.29	20.47	20.51	20.52	20.52	20.49	20.22	19.77	19.41	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.88	0.7	0.49	0.34	0.39	0.67	0.94	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	525.61	603.96	687.16	730.77	640.49	443.04	294.92	309	467.68	550.33	512.71	498.7	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1182.8	1147.08	1043.37	872.01	669.32	445.57	295.13	309.5	483.97	734.5	972.26	1174.23	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	488.95	364.98	265.02	101.69	21.45	0	0	0	0	137.02	330.88	502.59

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2212.58 (98)

Space heating requirement in kWh/m²/year 25.46 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	488.95	364.98	265.02	101.69	21.45	0	0	0	0	137.02	330.88	502.59	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	522.95	390.35	283.44	108.76	22.94	0	0	0	0	146.55	353.88	537.53	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2366.4 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

202.38	178.34	187.19	167.67	164.21	146.59	140.64	154.52	154.3	173.87	184.02	197.46

Efficiency of water heater 79.8 (216)

(217)m=	87.08	86.68	85.74	83.53	80.91	79.8	79.8	79.8	79.8	84.19	86.36	87.2	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	232.4	205.73	218.32	200.73	202.97	183.69	176.24	193.63	193.36	206.53	213.08	226.44

Total = Sum(219a)$_{1...12}$ = 2453.14 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2366.4
Water heating fuel used		2453.14
Electricity for pumps, fans and electric keep-hot		

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central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			370.17	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	511.14	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	529.88	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1041.02	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	192.12	(268)
Total CO2, kg/year		sum of (265)…(271) =		1272.06	(272)

TER = 14.64 (273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-6-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.18	(1a) x	2.4	(2a) =	170.83	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.18	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.83	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			8.05	x1/[1/(1.2)+ 0.04]		=	9.22			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	39.96	17.02	22.94	x	0.18	=	4.13			(29)
Walls Type2	5.87	2.1	3.77	x	0.18	=	0.68			(29)
Total area of elements, m²			45.83							(31)
Party wall			39.46	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 26.82 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.1 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 36.92 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	65.11	65.11	65.11	65.11	65.11	65.11	65.11	65.11	65.11	65.11	65.11	65.11	

Average = Sum(39)$_{1…12}$ /12= 65.11 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.27 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	97.04	93.51	89.98	86.45	82.92	79.4	79.4	82.92	86.45	89.98	93.51	97.04	

Total = Sum(44)$_{1...12}$ = 1058.61 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	143.91	125.86	129.88	113.23	108.65	93.75	86.88	99.69	100.88	117.57	128.34	139.37	

Total = Sum(45)$_{1...12}$ = 1388.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	21.59	18.88	19.48	16.98	16.3	14.06	13.03	14.95	15.13	17.64	19.25	20.9	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.18	175.79	185.15	166.72	163.92	147.25	142.15	154.97	154.38	172.85	181.83	194.64	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.18	175.79	185.15	166.72	163.92	147.25	142.15	154.97	154.38	172.85	181.83	194.64	

Output from water heater (annual)$_{1...12}$ 2038.85 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.07	81.79	87.41	80.44	80.35	73.97	73.11	77.37	76.34	83.31	85.47	90.56	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.83	15.84	12.88	9.75	7.29	6.15	6.65	8.64	11.6	14.73	17.19	18.33	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.04	202.11	196.88	185.74	171.69	158.48	149.65	147.57	152.81	163.94	178	191.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	(71)

Water heating gains (Table 5)

(72)m=	123.75	121.71	117.48	111.73	107.99	102.73	98.26	103.99	106.03	111.98	118.7	121.72	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	398.74	396.78	384.36	364.34	344.09	324.48	311.68	317.33	327.55	347.77	371.01	388.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)

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North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
East	0.9x	1	x	8.05	x	19.64	x	0.5	x	0.8	=	43.83	(76)
East	0.9x	1	x	8.05	x	38.42	x	0.5	x	0.8	=	85.73	(76)
East	0.9x	1	x	8.05	x	63.27	x	0.5	x	0.8	=	141.19	(76)
East	0.9x	1	x	8.05	x	92.28	x	0.5	x	0.8	=	205.92	(76)
East	0.9x	1	x	8.05	x	113.09	x	0.5	x	0.8	=	252.36	(76)
East	0.9x	1	x	8.05	x	115.77	x	0.5	x	0.8	=	258.34	(76)
East	0.9x	1	x	8.05	x	110.22	x	0.5	x	0.8	=	245.95	(76)
East	0.9x	1	x	8.05	x	94.68	x	0.5	x	0.8	=	211.27	(76)
East	0.9x	1	x	8.05	x	73.59	x	0.5	x	0.8	=	164.21	(76)
East	0.9x	1	x	8.05	x	45.59	x	0.5	x	0.8	=	101.73	(76)

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East	0.9x	1	x	8.05	x	24.49	x	0.5	x	0.8	=	54.65	(76)
East	0.9x	1	x	8.05	x	16.15	x	0.5	x	0.8	=	36.04	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	70.27	136.26	227.05	343.83	438.14	457.22	431.63	358.58	267.44	161.88	87.26	58.08	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	469	533.04	611.41	708.17	782.23	781.7	743.31	675.91	594.99	509.65	458.28	446.46	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.73	0.53	0.38	0.44	0.72	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.28	20.52	20.79	20.95	20.99	21	21	20.97	20.73	20.38	20.11	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.16	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.87	0.68	0.46	0.31	0.36	0.64	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.01	19.21	19.55	19.92	20.11	20.15	20.15	20.15	20.13	19.85	19.35	18.96	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.47	19.64	19.94	20.27	20.45	20.49	20.49	20.49	20.47	20.21	19.76	19.42	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.47	19.64	19.94	20.27	20.45	20.49	20.49	20.49	20.47	20.21	19.76	19.42	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.96	0.88	0.7	0.49	0.34	0.39	0.67	0.93	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	466.29	526.23	588.62	620.86	544.25	380.76	253.19	265.84	399.24	473.96	452.39	444.49	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	987.43	959.81	874.94	740.32	569.57	383.38	253.43	266.41	414.48	625.41	824.51	990.67	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	387.73	291.37	213.03	86.01	18.84	0	0	0	0	112.68	267.93	406.35	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 1783.94 (98)

Space heating requirement in kWh/m²/year 25.06 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1783.94	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1873.14	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2038.85	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2140.79	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	40.14	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.06	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	46.06	(331)
Energy for lighting (calculated in Appendix L)		314.94	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	932.27	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	20.83	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	953.1	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				953.1	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	23.9	(378)

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CO2 associated with electricity for lighting	(332))) x	0.52	=	163.45	(379)
Total CO2, kg/year	sum of (376)…(382) =			1140.46	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.02	(384)
EI rating (section 14)				86.85	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-6-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.18	(1a) x	2.4	(2a) =	170.83	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.18	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		170.83	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.43	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.88	x1/[1/(1.4)+ 0.04]		=	6.47			(27)
Windows Type 2			1.7	x1/[1/(1.4)+ 0.04]		=	2.25			(27)
Windows Type 3			7.42	x1/[1/(1.4)+ 0.04]		=	9.84			(27)
Windows Type 4			1.7	x1/[1/(1.4)+ 0.04]		=	2.25			(27)
Walls Type1	39.96	15.7	24.26	x	0.18	=	4.37			(29)
Walls Type2	5.87	2.1	3.77	x	0.18	=	0.68			(29)
Total area of elements, m²			45.83							(31)
Party wall			39.46	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	27.96	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		4.2	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	32.16	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.18	33.95	33.72	32.65	32.45	31.52	31.52	31.34	31.88	32.45	32.86	33.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	66.35	66.11	65.89	64.81	64.61	63.68	63.68	63.51	64.04	64.61	65.02	65.44	

Average = Sum(39)$_{1…12}$ /12= 64.81 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.91	0.91	0.89	0.89	0.89	0.9	0.91	0.91	0.92

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.27 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	97.04	93.51	89.98	86.45	82.92	79.4	79.4	82.92	86.45	89.98	93.51	97.04

Total = Sum(44)$_{1...12}$ = 1058.61 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.91	125.86	129.88	113.23	108.65	93.75	86.88	99.69	100.88	117.57	128.34	139.37

Total = Sum(45)$_{1...12}$ = 1388.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.59	18.88	19.48	16.98	16.3	14.06	13.03	14.95	15.13	17.64	19.25	20.9	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	190.5	167.95	176.47	158.32	155.24	138.85	133.47	146.29	145.98	164.17	173.43	185.96	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	190.5	167.95	176.47	158.32	155.24	138.85	133.47	146.29	145.98	164.17	173.43	185.96

Output from water heater (annual)$_{1...12}$ 1936.62 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.12	75.52	80.46	73.72	73.4	67.25	66.16	70.42	69.62	76.37	78.75	83.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.84	15.84	12.88	9.75	7.29	6.16	6.65	8.65	11.6	14.74	17.2	18.33	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.04	202.11	196.88	185.74	171.69	158.48	149.65	147.57	152.81	163.94	178	191.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	(71)

Water heating gains (Table 5)

(72)m=	114.42	112.38	108.15	102.39	98.66	93.4	88.93	94.66	96.69	102.65	109.37	112.39	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	392.4	390.45	378.03	358.01	337.75	318.15	305.35	310.99	321.22	341.44	364.68	382.05	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.88	x	10.63	x	0.63	x	0.7	=	15.86	(74)
North	0.9x	0.77	x	1.7	x	10.63	x	0.63	x	0.7	=	5.52	(74)
North	0.9x	0.77	x	1.7	x	10.63	x	0.63	x	0.7	=	5.52	(74)
North	0.9x	0.77	x	4.88	x	20.32	x	0.63	x	0.7	=	30.31	(74)
North	0.9x	0.77	x	1.7	x	20.32	x	0.63	x	0.7	=	10.56	(74)

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North	0.9x	0.77	x	1.7	x	20.32	x	0.63	x	0.7	=	10.56	(74)
North	0.9x	0.77	x	4.88	x	34.53	x	0.63	x	0.7	=	51.5	(74)
North	0.9x	0.77	x	1.7	x	34.53	x	0.63	x	0.7	=	17.94	(74)
North	0.9x	0.77	x	1.7	x	34.53	x	0.63	x	0.7	=	17.94	(74)
North	0.9x	0.77	x	4.88	x	55.46	x	0.63	x	0.7	=	82.72	(74)
North	0.9x	0.77	x	1.7	x	55.46	x	0.63	x	0.7	=	28.82	(74)
North	0.9x	0.77	x	1.7	x	55.46	x	0.63	x	0.7	=	28.82	(74)
North	0.9x	0.77	x	4.88	x	74.72	x	0.63	x	0.7	=	111.43	(74)
North	0.9x	0.77	x	1.7	x	74.72	x	0.63	x	0.7	=	38.82	(74)
North	0.9x	0.77	x	1.7	x	74.72	x	0.63	x	0.7	=	38.82	(74)
North	0.9x	0.77	x	4.88	x	79.99	x	0.63	x	0.7	=	119.29	(74)
North	0.9x	0.77	x	1.7	x	79.99	x	0.63	x	0.7	=	41.56	(74)
North	0.9x	0.77	x	1.7	x	79.99	x	0.63	x	0.7	=	41.56	(74)
North	0.9x	0.77	x	4.88	x	74.68	x	0.63	x	0.7	=	111.37	(74)
North	0.9x	0.77	x	1.7	x	74.68	x	0.63	x	0.7	=	38.8	(74)
North	0.9x	0.77	x	1.7	x	74.68	x	0.63	x	0.7	=	38.8	(74)
North	0.9x	0.77	x	4.88	x	59.25	x	0.63	x	0.7	=	88.36	(74)
North	0.9x	0.77	x	1.7	x	59.25	x	0.63	x	0.7	=	30.78	(74)
North	0.9x	0.77	x	1.7	x	59.25	x	0.63	x	0.7	=	30.78	(74)
North	0.9x	0.77	x	4.88	x	41.52	x	0.63	x	0.7	=	61.92	(74)
North	0.9x	0.77	x	1.7	x	41.52	x	0.63	x	0.7	=	21.57	(74)
North	0.9x	0.77	x	1.7	x	41.52	x	0.63	x	0.7	=	21.57	(74)
North	0.9x	0.77	x	4.88	x	24.19	x	0.63	x	0.7	=	36.08	(74)
North	0.9x	0.77	x	1.7	x	24.19	x	0.63	x	0.7	=	12.57	(74)
North	0.9x	0.77	x	1.7	x	24.19	x	0.63	x	0.7	=	12.57	(74)
North	0.9x	0.77	x	4.88	x	13.12	x	0.63	x	0.7	=	19.56	(74)
North	0.9x	0.77	x	1.7	x	13.12	x	0.63	x	0.7	=	6.82	(74)
North	0.9x	0.77	x	1.7	x	13.12	x	0.63	x	0.7	=	6.82	(74)
North	0.9x	0.77	x	4.88	x	8.86	x	0.63	x	0.7	=	13.22	(74)
North	0.9x	0.77	x	1.7	x	8.86	x	0.63	x	0.7	=	4.61	(74)
North	0.9x	0.77	x	1.7	x	8.86	x	0.63	x	0.7	=	4.61	(74)
East	0.9x	1	x	7.42	x	19.64	x	0.63	x	0.7	=	44.54	(76)
East	0.9x	1	x	7.42	x	38.42	x	0.63	x	0.7	=	87.12	(76)
East	0.9x	1	x	7.42	x	63.27	x	0.63	x	0.7	=	143.48	(76)
East	0.9x	1	x	7.42	x	92.28	x	0.63	x	0.7	=	209.26	(76)
East	0.9x	1	x	7.42	x	113.09	x	0.63	x	0.7	=	256.45	(76)
East	0.9x	1	x	7.42	x	115.77	x	0.63	x	0.7	=	262.53	(76)
East	0.9x	1	x	7.42	x	110.22	x	0.63	x	0.7	=	249.94	(76)
East	0.9x	1	x	7.42	x	94.68	x	0.63	x	0.7	=	214.69	(76)
East	0.9x	1	x	7.42	x	73.59	x	0.63	x	0.7	=	166.87	(76)
East	0.9x	1	x	7.42	x	45.59	x	0.63	x	0.7	=	103.38	(76)

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East	0.9x	1	x	7.42	x	24.49	x	0.63	x	0.7	=	55.53	(76)
East	0.9x	1	x	7.42	x	16.15	x	0.63	x	0.7	=	36.63	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	71.44	138.55	230.86	349.61	445.52	464.93	438.9	364.61	271.93	164.59	88.73	59.06	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	463.85	528.99	608.89	707.62	783.27	783.07	744.25	675.61	593.15	506.03	453.41	441.1	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.73	0.52	0.38	0.43	0.71	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.26	20.5	20.8	20.95	21	21	21	20.97	20.74	20.37	20.09	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.15	20.16	20.16	20.17	20.17	20.17	20.17	20.16	20.16	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.87	0.67	0.45	0.31	0.35	0.64	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.95	19.17	19.52	19.93	20.12	20.17	20.17	20.17	20.15	19.86	19.35	18.93	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.42	19.6	19.91	20.28	20.45	20.5	20.5	20.5	20.48	20.21	19.76	19.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.42	19.6	19.91	20.28	20.45	20.5	20.5	20.5	20.48	20.21	19.76	19.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.96	0.88	0.69	0.48	0.33	0.39	0.67	0.93	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	461.34	522.58	587.03	619.8	541.69	373.57	248.34	260.17	394.55	470.98	447.86	439.28	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1003.04	972.16	883.73	737.36	565.64	375.68	248.53	260.61	408.33	621.06	823.04	994.48	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	403.03	302.11	220.75	84.64	17.82	0	0	0	0	111.66	270.13	413.07	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = | 1823.21 | (98)

Space heating requirement in kWh/m²/year | 25.61 | (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system | 0 | (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	403.03	302.11	220.75	84.64	17.82	0	0	0	0	111.66	270.13	413.07		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	431.05	323.12	236.09	90.53	19.06	0	0	0	0	119.42	288.91	441.79		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													1949.96	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	190.5	167.95	176.47	158.32	155.24	138.85	133.47	146.29	145.98	164.17	173.43	185.96		
Efficiency of water heater													79.8	(216)
(217)m=	86.77	86.36	85.41	83.23	80.78	79.8	79.8	79.8	79.8	83.81	85.99	86.88		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	219.56	194.47	206.61	190.23	192.17	173.99	167.26	183.32	182.93	195.87	201.68	214.03		
Total = Sum(219a)$_{1...12}$ =													2322.13	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1949.96	
Water heating fuel used			2322.13	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			315.03	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	421.19	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	501.58	(264)
Space and water heating	(261) + (262) + (263) + (264) =				922.77	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	163.5	(268)

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Total CO2, kg/year	sum of (265)…(271) =	1125.19	(272)
TER =		15.81	(273)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-6-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	69.44	(1a) x	2.4	(2a) =	166.66	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	69.44	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	166.66	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	43.96	14.72	29.24	x	0.18	=	5.26			(29)
Walls Type2	32.4	2.1	30.3	x	0.18	=	5.45			(29)
Total area of elements, m²			76.36							(31)
Party wall			14.75	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.09 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.72 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 41.81 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	

Average = Sum(39)$_{1…12}$ /12= 69.31 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	1	1	1	1	1	1	1	1	1	1	1

Average = Sum(40)$_{1…12}$ /12= 1 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.23 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	95.94	92.45	88.97	85.48	81.99	78.5	78.5	81.99	85.48	88.97	92.45	95.94

Total = Sum(44)$_{1…12}$ = 1046.65 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	142.28	124.44	128.41	111.95	107.42	92.7	85.9	98.57	99.74	116.24	126.89	137.79

Total = Sum(45)$_{1…12}$ = 1372.32 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.34	18.67	19.26	16.79	16.11	13.9	12.88	14.78	14.96	17.44	19.03	20.67	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	197.56	174.37	183.69	165.44	162.7	146.19	141.17	153.84	153.24	171.52	180.38	193.07	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	197.56	174.37	183.69	165.44	162.7	146.19	141.17	153.84	153.24	171.52	180.38	193.07	

Output from water heater (annual)$_{1...12}$	2023.16	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.53	81.32	86.92	80.02	79.94	73.62	72.78	76.99	75.96	82.87	84.98	90.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.47	15.52	12.62	9.55	7.14	6.03	6.52	8.47	11.37	14.43	16.85	17.96	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	195.99	198.02	192.9	181.98	168.21	155.27	146.62	144.59	149.71	160.62	174.4	187.34	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	(71)

Water heating gains (Table 5)

(72)m=	123.02	121.01	116.83	111.14	107.44	102.24	97.82	103.49	105.5	111.39	118.03	121.02	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	392.97	391.03	378.83	359.16	339.29	320.03	307.45	313.03	323.07	342.93	365.76	382.8	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)

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East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)

South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	149.28	254.06	345.55	422.33	466	459.07	444.11	412.37	372.43	280.37	178.8	127.74	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	542.25	645.09	724.38	781.49	805.28	779.1	751.55	725.4	695.5	623.3	544.56	510.54	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.88	0.74	0.56	0.4	0.44	0.66	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.14	20.33	20.56	20.79	20.93	20.99	21	21	20.97	20.78	20.4	20.09	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.94	0.85	0.69	0.48	0.32	0.35	0.58	0.87	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.95	19.22	19.55	19.85	20.03	20.08	20.08	20.08	20.07	19.85	19.33	18.87	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.43	19.66	19.95	20.23	20.39	20.44	20.45	20.45	20.43	20.22	19.76	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.43	19.66	19.95	20.23	20.39	20.44	20.45	20.45	20.43	20.22	19.76	19.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.93	0.85	0.7	0.51	0.35	0.39	0.61	0.88	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	535.81	626.54	676.49	665.26	567.7	400	266.34	279.85	425.99	546.36	529.93	506.02	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1048.33	1023.27	932.4	785.02	602.23	404.92	266.84	280.66	438.62	666.98	877.59	1050.69	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	381.32	266.6	190.4	86.23	25.69	0	0	0	0	89.74	250.32	405.23

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1695.52 (98)

Space heating requirement in kWh/m²/year 24.42 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1695.52	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1780.3	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2023.16	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2124.32	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	39.05	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		44.93	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	44.93	(331)

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Energy for lighting (calculated in Appendix L)			308.57	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	= 906.88	(367)
Electrical energy for heat distribution	[(313) x		0.52	= 20.26	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			= 927.14	(373)
CO2 associated with space heating (secondary)	(309) x		0	= 0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	= 0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			927.14	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	= 23.32	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	= 160.15	(379)
Total CO2, kg/year	sum of (376)…(382) =			1110.61	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.99	(384)
EI rating (section 14)				87	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-6-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	69.44	(1a) x	2.4	(2a) =	166.66	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	69.44	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	166.66	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20 ÷ (5) =	0.12	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.37	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.39	0.35	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 5			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	43.96	14.72	29.24	x	0.18	=	5.26			(29)
Walls Type2	32.4	2.1	30.3	x	0.18	=	5.45			(29)
Total area of elements, m²			76.36							(31)
Party wall			14.75	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	32.33	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		6.99	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	39.32	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	31.92	31.75	31.58	30.79	30.64	29.95	29.95	29.83	30.22	30.64	30.94	31.25	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	71.24	71.07	70.9	70.11	69.97	69.28	69.28	69.15	69.54	69.97	70.27	70.58	

Average = $Sum(39)_{1...12}$ /12= 70.11 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.03	1.02	1.02	1.01	1.01	1	1	1	1	1.01	1.01	1.02	

Average = $Sum(40)_{1...12}$ /12= 1.01 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.23 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	95.94	92.45	88.97	85.48	81.99	78.5	78.5	81.99	85.48	88.97	92.45	95.94	

Total = $Sum(44)_{1...12}$ = 1046.65 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	142.28	124.44	128.41	111.95	107.42	92.7	85.9	98.57	99.74	116.24	126.89	137.79	

Total = $Sum(45)_{1...12}$ = 1372.32 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.34	18.67	19.26	16.79	16.11	13.9	12.88	14.78	14.96	17.44	19.03	20.67	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	188.88	166.53	175.01	157.04	154.01	137.79	132.49	145.16	144.84	162.84	171.98	184.39	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	188.88	166.53	175.01	157.04	154.01	137.79	132.49	145.16	144.84	162.84	171.98	184.39

Output from water heater (annual)$_{1...12}$	1920.94	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.58	75.04	79.97	73.3	72.99	66.89	65.84	70.05	69.24	75.93	78.26	83.09	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.51	15.55	12.65	9.57	7.16	6.04	6.53	8.49	11.39	14.46	16.88	18	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	195.99	198.02	192.9	181.98	168.21	155.27	146.62	144.59	149.71	160.62	174.4	187.34	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	(71)

Water heating gains (Table 5)

(72)m=	113.69	111.67	107.49	101.8	98.11	92.91	88.49	94.15	96.16	102.05	108.7	111.68	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	386.67	384.73	372.52	352.85	332.97	313.71	301.13	306.71	316.75	336.62	359.46	376.5	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)

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East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
South	0.9x	0.77	x	1.84	x	46.75	x	0.63	x	0.7	=	26.29	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.63	x	0.7	=	65.72	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.63	x	0.7	=	43.06	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.63	x	0.7	=	107.64	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.63	x	0.7	=	54.85	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.63	x	0.7	=	137.12	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.63	x	0.7	=	61.99	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.63	x	0.7	=	154.97	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.63	x	0.7	=	64.6	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.63	x	0.7	=	161.49	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.63	x	0.7	=	62.16	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.63	x	0.7	=	155.41	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.63	x	0.7	=	60.74	(78)

South	0.9x	0.77	x	4.6	x	108.01	x	0.63	x	0.7	=	151.85	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.63	x	0.7	=	58.99	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.63	x	0.7	=	147.46	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.63	x	0.7	=	57.29	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.63	x	0.7	=	143.23	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.63	x	0.7	=	46.44	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.63	x	0.7	=	116.1	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.63	x	0.7	=	31.16	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.63	x	0.7	=	77.91	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.63	x	0.7	=	22.72	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.63	x	0.7	=	56.79	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	164.58	280.1	380.97	465.61	513.76	506.12	489.63	454.64	410.61	309.11	197.13	140.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	551.25	664.83	753.49	818.46	846.73	819.83	790.75	761.36	727.36	645.73	556.59	517.34	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.86	0.72	0.53	0.38	0.42	0.64	0.89	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.32	20.56	20.8	20.94	20.99	21	21	20.98	20.79	20.4	20.07	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.06	20.06	20.07	20.08	20.08	20.09	20.09	20.09	20.08	20.08	20.07	20.07	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.83	0.66	0.46	0.31	0.33	0.56	0.86	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.89	19.19	19.54	19.86	20.03	20.08	20.08	20.09	20.07	19.86	19.32	18.84	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.38	19.64	19.95	20.24	20.39	20.44	20.45	20.45	20.43	20.23	19.75	19.33	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.38	19.64	19.95	20.24	20.39	20.44	20.45	20.45	20.43	20.23	19.75	19.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.93	0.84	0.68	0.49	0.34	0.37	0.59	0.87	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	544.38	644.05	698.77	683.84	577.84	401.01	266.37	279.5	429.52	559.1	540.57	512.53	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1074.32	1047.62	953.4	794.97	608.16	404.88	266.75	280.12	440.23	673.83	889.18	1067.9	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	394.27	271.2	189.44	80.01	22.56	0	0	0	0	85.36	251	413.19

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1707.03 (98)

Space heating requirement in kWh/m²/year 24.58 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	394.27	271.2	189.44	80.01	22.56	0	0	0	0	85.36	251	413.19		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	421.68	290.05	202.61	85.57	24.12	0	0	0	0	91.3	268.45	441.91		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													1825.7	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

Output from water heater (calculated above)	188.88	166.53	175.01	157.04	154.01	137.79	132.49	145.16	144.84	162.84	171.98	184.39		
Efficiency of water heater													79.8	(216)
(217)m=	86.73	86.11	85.03	83.12	81.02	79.8	79.8	79.8	79.8	83.18	85.82	86.9		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	217.77	193.39	205.83	188.94	190.09	172.67	166.03	181.91	181.5	195.76	200.39	212.17		
Total = Sum(219a)$_{1...12}$ =													2306.43	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1825.7
Water heating fuel used		2306.43
Electricity for pumps, fans and electric keep-hot		

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central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			309.22	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	394.35	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	498.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =				892.54	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	160.49	(268)
Total CO2, kg/year			sum of (265)…(271) =		1091.95	(272)

TER =	15.73	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-6-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.53	(1a) x	2.4	(2a) =	171.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.53	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.67	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	38.18	16.1	22.08	x	0.18	=	3.97			(29)
Walls Type2	15.79	2.1	13.69	x	0.18	=	2.46			(29)
Total area of elements, m²			53.97							(31)
Party wall			38.51	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 27.39 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.31 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 37.7 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	66.03	66.03	66.03	66.03	66.03	66.03	66.03	66.03	66.03	66.03	66.03	66.03	

Average = Sum(39)$_{1…12}$ /12= 66.03 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92

Average = Sum(40)$_{1…12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.28 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.41 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	97.26	93.72	90.18	86.65	83.11	79.57	79.57	83.11	86.65	90.18	93.72	97.26	
										Total = Sum(44)$_{1…12}$ =		1060.97	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	144.23	126.14	130.17	113.48	108.89	93.96	87.07	99.91	101.11	117.83	128.62	139.68	
										Total = Sum(45)$_{1…12}$ =		1391.09	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	21.63	18.92	19.53	17.02	16.33	14.09	13.06	14.99	15.17	17.67	19.29	20.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.5	176.07	185.44	166.98	164.17	147.46	142.35	155.19	154.6	173.11	182.12	194.95	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.5	176.07	185.44	166.98	164.17	147.46	142.35	155.19	154.6	173.11	182.12	194.95	

Output from water heater (annual)$_{1...12}$ 2041.93 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.18	81.88	87.5	80.53	80.43	74.04	73.17	77.44	76.41	83.4	85.56	90.66	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.91	15.9	12.93	9.79	7.32	6.18	6.68	8.68	11.65	14.79	17.26	18.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.84	202.93	197.67	186.49	172.38	159.11	150.25	148.17	153.42	164.6	178.71	191.98	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	(71)

Water heating gains (Table 5)

(72)m=	123.89	121.85	117.61	111.84	108.1	102.83	98.35	104.09	106.13	112.1	118.84	121.86	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	399.88	397.92	385.46	365.37	345.04	325.36	312.52	318.18	328.44	348.73	372.05	389.48	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	5.29	x	46.75	x	0.5	x	0.8	=	68.56	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	5.29	x	76.57	x	0.5	x	0.8	=	112.28	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	5.29	x	97.53	x	0.5	x	0.8	=	143.02	(78)

South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	5.29	x	110.23	x	0.5	x	0.8	=	161.65	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	5.29	x	114.87	x	0.5	x	0.8	=	168.45	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	5.29	x	110.55	x	0.5	x	0.8	=	162.11	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	5.29	x	108.01	x	0.5	x	0.8	=	158.39	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	5.29	x	104.89	x	0.5	x	0.8	=	153.82	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	5.29	x	101.89	x	0.5	x	0.8	=	149.4	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	5.29	x	82.59	x	0.5	x	0.8	=	121.1	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	5.29	x	55.42	x	0.5	x	0.8	=	81.26	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	5.29	x	40.4	x	0.5	x	0.8	=	59.24	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)

West	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	148.15	256.59	358.83	451.9	508.69	505.02	486.97	445.33	391.57	286.02	178.31	126.19	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	548.03	654.51	744.29	817.27	853.73	830.38	799.49	763.51	720	634.75	550.36	515.67	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.85	0.69	0.5	0.36	0.4	0.62	0.89	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.42	20.65	20.85	20.96	21	21	21	20.98	20.83	20.48	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.81	0.63	0.44	0.29	0.32	0.55	0.85	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.14	19.41	19.72	19.99	20.12	20.14	20.15	20.15	20.14	19.97	19.5	19.06	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.58	19.81	20.09	20.34	20.46	20.48	20.49	20.49	20.48	20.32	19.89	19.51	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.58	19.81	20.09	20.34	20.46	20.48	20.49	20.49	20.48	20.32	19.89	19.51	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.82	0.65	0.47	0.32	0.35	0.57	0.86	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	541.56	634.56	687.92	671.34	558.98	386.42	256.56	269.6	413.93	547.13	535.01	511.23	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1008.68	984.59	897.48	755.15	578.11	388.58	256.74	269.93	421.02	641.51	844.53	1010.96	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	347.53	235.22	155.92	60.34	14.23	0	0	0	0	70.22	222.85	371.8	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = | 1478.12 | (98)

Space heating requirement in kWh/m²/year | 20.66 | (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1478.12	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1552.03	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2041.93	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2144.03	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	36.96	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.29	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	46.29	(331)
Energy for lighting (calculated in Appendix L)		316.21	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	858.44	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	19.18	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	877.62	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				877.62	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	24.02	(378)

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CO2 associated with electricity for lighting	(332))) x	0.52	=	164.11	(379)
Total CO2, kg/year	sum of (376)…(382) =			1065.76	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			14.9	(384)
EI rating (section 14)				87.74	(385)

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User Details:

Assessor Name: **Stroma Number:**
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.8

Property Address: b1-6-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.53	(1a) x	2.4	(2a) =	171.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.53	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.67	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30 ÷ (5) =	0.17	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.19	x1/[1/(1.4)+ 0.04]		=	6.88			(27)
Windows Type 2			2.71	x1/[1/(1.4)+ 0.04]		=	3.59			(27)
Windows Type 3			5.19	x1/[1/(1.4)+ 0.04]		=	6.88			(27)
Windows Type 4			2.71	x1/[1/(1.4)+ 0.04]		=	3.59			(27)
Walls Type1	38.18	15.8	22.38	x	0.18	=	4.03			(29)
Walls Type2	15.79	2.1	13.69	x	0.18	=	2.46			(29)
Total area of elements, m²			53.97							(31)
Party wall			38.51	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 29.54 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.11 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 34.65 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.33	34.1	33.87	32.79	32.59	31.66	31.66	31.49	32.02	32.59	33	33.42	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	68.98	68.74	68.52	67.44	67.24	66.31	66.31	66.13	66.67	67.24	67.65	68.07	

Average = Sum(39)$_{1…12}$ /12= 67.44 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.96	0.96	0.96	0.94	0.94	0.93	0.93	0.92	0.93	0.94	0.95	0.95

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.28 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.41 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	97.26	93.72	90.18	86.65	83.11	79.57	79.57	83.11	86.65	90.18	93.72	97.26

Total = Sum(44)$_{1...12}$ = 1060.97 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.23	126.14	130.17	113.48	108.89	93.96	87.07	99.91	101.11	117.83	128.62	139.68

Total = Sum(45)$_{1...12}$ = 1391.09 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.63	18.92	19.53	17.02	16.33	14.09	13.06	14.99	15.17	17.67	19.29	20.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	190.82	168.23	176.76	158.57	155.48	139.06	133.67	146.51	146.2	164.43	173.71	186.27	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	190.82	168.23	176.76	158.57	155.48	139.06	133.67	146.51	146.2	164.43	173.71	186.27	

Output from water heater (annual)$_{1...12}$ 1939.71 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.23	75.61	80.56	73.81	73.48	67.32	66.23	70.5	69.69	76.46	78.84	83.72	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.91	15.91	12.94	9.79	7.32	6.18	6.68	8.68	11.65	14.79	17.27	18.41	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.84	202.93	197.67	186.49	172.38	159.11	150.25	148.17	153.42	164.6	178.71	191.98	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	(71)

Water heating gains (Table 5)

(72)m=	114.56	112.52	108.27	102.51	98.77	93.49	89.01	94.75	96.79	102.76	109.5	112.52	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	393.55	391.59	379.12	359.04	338.71	319.03	306.19	311.84	322.11	342.4	365.72	383.15	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	5.19	x	46.75	x	0.63	x	0.7	=	74.15	(78)
South	0.9x	0.77	x	2.71	x	46.75	x	0.63	x	0.7	=	38.72	(78)
South	0.9x	0.77	x	5.19	x	76.57	x	0.63	x	0.7	=	121.45	(78)
South	0.9x	0.77	x	2.71	x	76.57	x	0.63	x	0.7	=	63.41	(78)
South	0.9x	0.77	x	5.19	x	97.53	x	0.63	x	0.7	=	154.7	(78)

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South	0.9x	0.77	x	2.71	x	97.53	x	0.63	x	0.7	=	80.78	(78)
South	0.9x	0.77	x	5.19	x	110.23	x	0.63	x	0.7	=	174.85	(78)
South	0.9x	0.77	x	2.71	x	110.23	x	0.63	x	0.7	=	91.3	(78)
South	0.9x	0.77	x	5.19	x	114.87	x	0.63	x	0.7	=	182.2	(78)
South	0.9x	0.77	x	2.71	x	114.87	x	0.63	x	0.7	=	95.14	(78)
South	0.9x	0.77	x	5.19	x	110.55	x	0.63	x	0.7	=	175.34	(78)
South	0.9x	0.77	x	2.71	x	110.55	x	0.63	x	0.7	=	91.56	(78)
South	0.9x	0.77	x	5.19	x	108.01	x	0.63	x	0.7	=	171.32	(78)
South	0.9x	0.77	x	2.71	x	108.01	x	0.63	x	0.7	=	89.46	(78)
South	0.9x	0.77	x	5.19	x	104.89	x	0.63	x	0.7	=	166.38	(78)
South	0.9x	0.77	x	2.71	x	104.89	x	0.63	x	0.7	=	86.87	(78)
South	0.9x	0.77	x	5.19	x	101.89	x	0.63	x	0.7	=	161.6	(78)
South	0.9x	0.77	x	2.71	x	101.89	x	0.63	x	0.7	=	84.38	(78)
South	0.9x	0.77	x	5.19	x	82.59	x	0.63	x	0.7	=	130.99	(78)
South	0.9x	0.77	x	2.71	x	82.59	x	0.63	x	0.7	=	68.4	(78)
South	0.9x	0.77	x	5.19	x	55.42	x	0.63	x	0.7	=	87.9	(78)
South	0.9x	0.77	x	2.71	x	55.42	x	0.63	x	0.7	=	45.9	(78)
South	0.9x	0.77	x	5.19	x	40.4	x	0.63	x	0.7	=	64.08	(78)
South	0.9x	0.77	x	2.71	x	40.4	x	0.63	x	0.7	=	33.46	(78)
West	0.9x	0.77	x	5.19	x	19.64	x	0.63	x	0.7	=	31.15	(80)
West	0.9x	0.77	x	2.71	x	19.64	x	0.63	x	0.7	=	16.27	(80)
West	0.9x	0.77	x	5.19	x	38.42	x	0.63	x	0.7	=	60.94	(80)
West	0.9x	0.77	x	2.71	x	38.42	x	0.63	x	0.7	=	31.82	(80)
West	0.9x	0.77	x	5.19	x	63.27	x	0.63	x	0.7	=	100.36	(80)
West	0.9x	0.77	x	2.71	x	63.27	x	0.63	x	0.7	=	52.4	(80)
West	0.9x	0.77	x	5.19	x	92.28	x	0.63	x	0.7	=	146.37	(80)
West	0.9x	0.77	x	2.71	x	92.28	x	0.63	x	0.7	=	76.43	(80)
West	0.9x	0.77	x	5.19	x	113.09	x	0.63	x	0.7	=	179.38	(80)
West	0.9x	0.77	x	2.71	x	113.09	x	0.63	x	0.7	=	93.66	(80)
West	0.9x	0.77	x	5.19	x	115.77	x	0.63	x	0.7	=	183.63	(80)
West	0.9x	0.77	x	2.71	x	115.77	x	0.63	x	0.7	=	95.88	(80)
West	0.9x	0.77	x	5.19	x	110.22	x	0.63	x	0.7	=	174.82	(80)
West	0.9x	0.77	x	2.71	x	110.22	x	0.63	x	0.7	=	91.28	(80)
West	0.9x	0.77	x	5.19	x	94.68	x	0.63	x	0.7	=	150.17	(80)
West	0.9x	0.77	x	2.71	x	94.68	x	0.63	x	0.7	=	78.41	(80)
West	0.9x	0.77	x	5.19	x	73.59	x	0.63	x	0.7	=	116.72	(80)
West	0.9x	0.77	x	2.71	x	73.59	x	0.63	x	0.7	=	60.95	(80)
West	0.9x	0.77	x	5.19	x	45.59	x	0.63	x	0.7	=	72.31	(80)
West	0.9x	0.77	x	2.71	x	45.59	x	0.63	x	0.7	=	37.76	(80)
West	0.9x	0.77	x	5.19	x	24.49	x	0.63	x	0.7	=	38.84	(80)
West	0.9x	0.77	x	2.71	x	24.49	x	0.63	x	0.7	=	20.28	(80)

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West	0.9x	0.77	x	5.19	x	16.15	x	0.63	x	0.7	=	25.62	(80)
West	0.9x	0.77	x	2.71	x	16.15	x	0.63	x	0.7	=	13.38	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	160.29	277.62	388.24	488.94	550.38	546.41	526.88	481.83	423.66	309.46	192.92	136.53	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	553.84	669.21	767.37	847.98	889.09	865.44	833.07	793.68	745.76	651.86	558.64	519.68	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.84	0.67	0.49	0.35	0.38	0.6	0.88	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.39	20.63	20.86	20.97	21	21	21	20.99	20.83	20.46	20.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.12	20.12	20.13	20.13	20.14	20.14	20.15	20.14	20.13	20.13	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.8	0.62	0.42	0.28	0.31	0.53	0.85	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.03	19.33	19.67	19.98	20.1	20.14	20.14	20.15	20.13	19.96	19.46	18.99	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.75	20.05	20.33	20.45	20.48	20.49	20.49	20.47	20.31	19.86	19.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.75	20.05	20.33	20.45	20.48	20.49	20.49	20.47	20.31	19.86	19.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.81	0.64	0.45	0.31	0.34	0.56	0.86	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	547.3	648.28	707.24	688.15	569.98	388.31	257.54	270.04	418.37	558.1	542.69	515.16	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1047.96	1020.9	928.65	770.83	588.25	390.12	257.7	270.32	424.86	652.73	863.12	1038.3	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	372.49	250.4	164.73	59.53	13.59	0	0	0	0	70.41	230.71	389.22	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1551.08 (98)

Space heating requirement in kWh/m²/year 21.68 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	372.49	250.4	164.73	59.53	13.59	0	0	0	0	70.41	230.71	389.22		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	398.39	267.81	176.18	63.67	14.54	0	0	0	0	75.3	246.75	416.28		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1658.91	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	190.82	168.23	176.76	158.57	155.48	139.06	133.67	146.51	146.2	164.43	173.71	186.27		
Efficiency of water heater													79.8	(216)
(217)m=	86.57	85.87	84.63	82.46	80.57	79.8	79.8	79.8	79.8	82.73	85.57	86.74		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	220.43	195.9	208.87	192.3	192.99	174.25	167.5	183.6	183.21	198.74	203	214.76		
Total = Sum(219a)$_{1...12}$ =													2335.56	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1658.91	
Water heating fuel used			2335.56	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			316.28	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	358.32	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	504.48	(264)
Space and water heating	(261) + (262) + (263) + (264) =				862.81	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	164.15	(268)

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Total CO2, kg/year	sum of (265)…(271) =	1065.88	(272)
TER =		14.9	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-6-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.7	(1a) x	2.4	(2a) =	121.68	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.7	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.68	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	16.08	6.44	9.64	x	0.18	=	1.74			(29)
Walls Type2	13.61	2.1	11.51	x	0.18	=	2.07			(29)
Total area of elements, m²			29.69							(31)
Party wall			43.39	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 13.7 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.78 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 20.49 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	40.56	40.56	40.56	40.56	40.56	40.56	40.56	40.56	40.56	40.56	40.56	40.56	

Average = Sum(39)$_{1…12}$ /12= 40.56 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.83 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.31	79.32	76.33	73.33	70.34	67.35	67.35	70.34	73.33	76.33	79.32	82.31	
										Total = Sum(44)$_{1...12}$ =		897.96	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22	
										Total = Sum(45)$_{1...12}$ =		1177.36	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.31	16.01	16.53	14.41	13.82	11.93	11.05	12.68	12.84	14.96	16.33	17.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	177.34	156.69	165.44	149.54	147.44	133.02	128.97	139.84	139.07	155	162.35	173.49	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	177.34	156.69	165.44	149.54	147.44	133.02	128.97	139.84	139.07	155	162.35	173.49	

Output from water heater (annual)1…12 1828.2 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.81	75.44	80.85	74.73	74.86	69.24	68.72	72.34	71.25	77.38	78.99	83.53	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.14	12.56	10.22	7.73	5.78	4.88	5.27	6.86	9.2	11.68	13.64	14.54	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	149.05	150.6	146.7	138.4	127.93	118.08	111.51	109.96	113.86	122.16	132.63	142.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	(71)

Water heating gains (Table 5)

(72)m=	113.99	112.26	108.67	103.79	100.62	96.16	92.37	97.23	98.96	104.01	109.71	112.27	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	325.85	324.08	314.25	298.59	283	267.79	257.82	262.71	270.68	286.51	304.64	317.94	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)

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West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	35.06	68.59	112.95	164.74	201.89	206.67	196.76	169.01	131.37	81.38	43.72	28.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	360.91	392.67	427.2	463.33	484.89	474.46	454.57	431.72	402.05	367.89	348.36	346.78	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.9	0.74	0.54	0.39	0.43	0.68	0.92	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.37	20.47	20.65	20.85	20.96	21	21	21	20.98	20.84	20.56	20.33	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.87	0.69	0.48	0.33	0.36	0.61	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.42	19.57	19.82	20.09	20.22	20.25	20.25	20.25	20.24	20.07	19.7	19.36	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.89	20.02	20.24	20.47	20.59	20.62	20.63	20.63	20.61	20.46	20.13	19.85	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.89	20.02	20.24	20.47	20.59	20.62	20.63	20.63	20.61	20.46	20.13	19.85	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.88	0.72	0.51	0.36	0.4	0.64	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	357.42	385.6	408.4	406.34	346.95	243.01	163.22	171.23	258.75	332.87	341.06	344.15	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	632.46	613.36	557.2	469.21	360.73	244.33	163.32	171.43	264.21	399.79	528.54	634.79	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	204.63	153.05	110.7	45.27	10.26	0	0	0	0	49.79	134.98	216.24	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 924.92 (98)

Space heating requirement in kWh/m²/year 18.24 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		924.92	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	971.17	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308

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Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		1828.2	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1919.61	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	28.91	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		32.81	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	32.81	(331)
Energy for lighting (calculated in Appendix L)		249.8	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	671.41	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	15	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	686.41	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				686.41	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	17.03	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	129.64	(379)
Total CO2, kg/year	sum of (376)…(382) =				833.08	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				16.43	(384)
EI rating (section 14)					88.34	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-6-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.7	(1a) x	2.4	(2a) =	121.68	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.7	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.68	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.84		x1/[1/(1.4)+ 0.04]	=	2.44			(27)
Windows Type 2			2.76		x1/[1/(1.4)+ 0.04]	=	3.66			(27)
Windows Type 3			1.84		x1/[1/(1.4)+ 0.04]	=	2.44			(27)
Walls Type1	16.08	6.44	9.64	x	0.18	=	1.74			(29)
Walls Type2	13.61	2.1	11.51	x	0.18	=	2.07			(29)
Total area of elements, m²			29.69							(31)
Party wall			43.39	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 14.44 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.97 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 17.42 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	24.13	23.97	23.81	23.09	22.96	22.32	22.32	22.21	22.57	22.96	23.23	23.52	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	41.55	41.39	41.23	40.51	40.38	39.74	39.74	39.63	39.99	40.38	40.65	40.94	

Average = Sum(39)$_{1…12}$ /12= 40.51 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.81	0.8	0.8	0.78	0.78	0.78	0.79	0.8	0.8	0.81

Average = Sum(40)$_{1…12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.83 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.31	79.32	76.33	73.33	70.34	67.35	67.35	70.34	73.33	76.33	79.32	82.31	
										Total = Sum(44)$_{1…12}$ =		897.96	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22	
										Total = Sum(45)$_{1…12}$ =		1177.36	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.31	16.01	16.53	14.41	13.82	11.93	11.05	12.68	12.84	14.96	16.33	17.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.66	148.85	156.76	141.14	138.75	124.62	120.29	131.16	130.67	146.32	153.95	164.81	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.66	148.85	156.76	141.14	138.75	124.62	120.29	131.16	130.67	146.32	153.95	164.81	

Output from water heater (annual)$_{1...12}$ 1725.98 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.86	69.17	73.91	68.01	67.92	62.52	61.78	65.39	64.53	70.44	72.27	76.58	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.56	12.94	10.52	7.96	5.95	5.03	5.43	7.06	9.48	12.03	14.04	14.97	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	149.05	150.6	146.7	138.4	127.93	118.08	111.51	109.96	113.86	122.16	132.63	142.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	(71)

Water heating gains (Table 5)

(72)m=	104.65	102.93	99.34	94.46	91.29	86.83	83.04	87.89	89.62	94.67	100.37	102.93	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	319.93	318.12	308.22	292.49	276.83	261.6	251.64	256.58	264.62	280.52	298.71	312.04	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)

West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	38.65	75.62	124.53	181.62	222.58	227.85	216.93	186.34	144.83	89.73	48.2	31.79	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	358.59	393.74	432.75	474.11	499.42	489.45	468.56	442.91	409.45	370.25	346.91	343.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.89	0.72	0.52	0.37	0.41	0.66	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.33	20.45	20.64	20.86	20.97	21	21	21	20.99	20.84	20.56	20.32	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.25	20.26	20.27	20.27	20.27	20.26	20.26	20.25	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.86	0.67	0.46	0.31	0.35	0.59	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.35	19.52	19.8	20.1	20.23	20.27	20.27	20.27	20.25	20.09	19.69	19.33	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.84	19.99	20.22	20.48	20.6	20.63	20.63	20.63	20.62	20.46	20.12	19.83	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.84	19.99	20.22	20.48	20.6	20.63	20.63	20.63	20.62	20.46	20.12	19.83	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.87	0.7	0.49	0.34	0.38	0.63	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	355.36	386.83	413.37	411.08	347.76	238.83	160.25	167.67	256.36	333.77	339.82	341.38	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	645.77	624.49	565.81	469.14	359.34	239.72	160.31	167.8	260.76	398.26	529.4	639.66	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	216.06	159.71	113.42	41.8	8.62	0	0	0	0	47.98	136.5	221.93	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 946.02 | (98)

Space heating requirement in kWh/m²/year | 18.66 | (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	216.06	159.71	113.42	41.8	8.62	0	0	0	0	47.98	136.5	221.93	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	231.08	170.81	121.31	44.71	9.22	0	0	0	0	51.31	145.99	237.36	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= | 1011.78 | (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= | 0 | (215)

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Water heating

Output from water heater (calculated above)

168.66	148.85	156.76	141.14	138.75	124.62	120.29	131.16	130.67	146.32	153.95	164.81

Efficiency of water heater 79.8 (216)

(217)m=	85.48	85	83.97	82.02	80.36	79.8	79.8	79.8	79.8	82.2	84.49	85.61	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	197.32	175.11	186.69	172.09	172.67	156.16	150.74	164.36	163.74	178.01	182.2	192.52

Total = Sum(219a)$_{1...12}$ = 2091.62 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1011.78	
Water heating fuel used			2091.62	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			257.21	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	218.54	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	451.79	(264)
Space and water heating	(261) + (262) + (263) + (264) =				670.33	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	133.49	(268)
Total CO2, kg/year			sum of (265)…(271) =		842.75	(272)

TER = 16.62 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-6-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.03	(1a) x	2.4	(2a) =	170.47	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.03	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.47	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 2			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	25.33	9.2	16.13	x	0.18	=	2.9			(29)
Walls Type2	13.71	2.1	11.61	x	0.18	=	2.09			(29)
Total area of elements, m²			39.04							(31)
Party wall			52.54	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	18.05	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		12.37	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	30.42	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	58.55	58.55	58.55	58.55	58.55	58.55	58.55	58.55	58.55	58.55	58.55	58.55	

Average = $Sum(39)_{1…12}$ /12= 58.55 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	

Average = Sum(40)$_{1…12}$ /12= 0.82 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.27 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.95	93.42	89.9	86.37	82.85	79.32	79.32	82.85	86.37	89.9	93.42	96.95	

Total = Sum(44)$_{1…12}$ = 1057.6 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.77	125.74	129.75	113.12	108.54	93.66	86.79	99.6	100.79	117.46	128.21	139.23	

Total = Sum(45)$_{1…12}$ = 1386.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.57	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.88	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.05	175.67	185.03	166.62	163.82	147.16	142.07	154.87	154.28	172.73	181.71	194.51	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.05	175.67	185.03	166.62	163.82	147.16	142.07	154.87	154.28	172.73	181.71	194.51	

Output from water heater (annual)$_{1...12}$ 2037.52 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.02	81.75	87.36	80.41	80.31	73.94	73.08	77.34	76.31	83.28	85.43	90.52	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	18.87	16.76	13.63	10.32	7.71	6.51	7.04	9.15	12.28	15.59	18.19	19.4	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	199.69	201.76	196.54	185.42	171.39	158.2	149.39	147.32	152.54	163.66	177.69	190.88	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	(71)
Water heating gains (Table 5)													
(72)m=	123.69	121.65	117.43	111.68	107.95	102.69	98.23	103.95	105.98	111.93	118.65	121.66	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	399.31	397.24	384.66	364.48	344.11	324.47	311.72	317.48	327.86	348.24	371.59	389	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)

West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	50.09	97.98	161.36	235.34	288.41	295.24	281.08	241.45	187.67	116.26	62.45	41.19	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	449.4	495.22	546.02	599.82	632.53	619.71	592.8	558.92	515.53	464.5	434.05	430.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.8	0.6	0.43	0.48	0.74	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.26	20.37	20.56	20.79	20.94	20.99	21	21	20.97	20.77	20.46	20.22	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.75	0.53	0.36	0.4	0.68	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.23	19.39	19.67	19.99	20.18	20.23	20.23	20.23	20.21	19.97	19.53	19.18	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.64	19.78	20.03	20.31	20.48	20.53	20.54	20.54	20.51	20.29	19.91	19.6	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.64	19.78	20.03	20.31	20.48	20.53	20.54	20.54	20.51	20.29	19.91	19.6	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.76	0.56	0.39	0.43	0.7	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	447.09	490.07	530.63	546.13	483.45	344.04	230.34	241.75	361.8	435.8	429.06	428.5	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	898.27	871.41	791.97	667.91	514.27	347.39	230.62	242.3	375.57	567.18	749.73	901.54	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	335.68	256.26	194.44	87.69	22.93	0	0	0	0	97.75	230.88	351.94	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1577.55 (98)

Space heating requirement in kWh/m²/year 22.21 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers 1 (303a)

Fraction of total space heat from Community boilers (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 1577.55

Space heat from Community boilers (98) x (304a) x (305) x (306) = 1656.43 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308

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Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2037.52	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2139.39	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	37.96	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		45.96	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	45.96	(331)
Energy for lighting (calculated in Appendix L)		333.28	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	881.61	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	19.7	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	901.31	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				901.31	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	23.85	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	172.97	(379)
Total CO2, kg/year	sum of (376)…(382) =				1098.14	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				15.46	(384)
EI rating (section 14)					87.32	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-6-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.03	(1a) x	2.4	(2a) =	170.47	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.03	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.47	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.43	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 2			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	25.33	9.2	16.13	x	0.18	=	2.9			(29)
Walls Type2	13.71	2.1	11.61	x	0.18	=	2.09			(29)
Total area of elements, m²			39.04							(31)
Party wall			52.54	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.29 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.18 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 22.47 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.12	33.89	33.66	32.59	32.39	31.46	31.46	31.28	31.82	32.39	32.8	33.22	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	56.59	56.36	56.13	55.06	54.86	53.93	53.93	53.75	54.29	54.86	55.27	55.69	

Average = Sum(39)$_{1…12}$ /12= 55.06 (39)

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Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	0.8	0.79	0.79	0.78	0.77	0.76	0.76	0.76	0.76	0.77	0.78	0.78

Average = Sum(40)$_{1...12}$ /12= 0.78 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.27 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 88.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	96.95	93.42	89.9	86.37	82.85	79.32	79.32	82.85	86.37	89.9	93.42	96.95

Total = Sum(44)$_{1...12}$ = 1057.6 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.77	125.74	129.75	113.12	108.54	93.66	86.79	99.6	100.79	117.46	128.21	139.23

Total = Sum(45)$_{1...12}$ = 1386.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.57	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.88	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.39 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) — 0.75 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	190.36	167.83	176.35	158.21	155.14	138.76	133.39	146.19	145.88	164.05	173.31	185.83	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	190.36	167.83	176.35	158.21	155.14	138.76	133.39	146.19	145.88	164.05	173.31	185.83	

Output from water heater (annual)$_{1...12}$ 1935.29 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.08	75.48	80.42	73.69	73.37	67.22	66.13	70.39	69.59	76.33	78.7	83.57	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.43	17.26	14.03	10.62	7.94	6.7	7.24	9.42	12.64	16.05	18.73	19.97	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.69	201.76	196.54	185.42	171.39	158.2	149.39	147.32	152.54	163.66	177.69	190.88	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	(71)

Water heating gains (Table 5)

(72)m=	114.35	112.32	108.09	102.34	98.61	93.36	88.89	94.61	96.65	102.59	109.31	112.33	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	393.53	391.4	378.73	358.45	338.01	318.33	305.59	311.41	321.89	342.36	365.8	383.24	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(80)

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West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	55.22	108.02	177.9	259.46	317.98	325.5	309.89	266.19	206.91	128.18	68.85	45.41	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	448.76	499.42	556.63	617.91	655.98	643.83	615.48	577.61	528.8	470.54	434.65	428.65	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.9	0.74	0.53	0.39	0.43	0.69	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.3	20.42	20.62	20.85	20.97	21	21	21	20.99	20.82	20.52	20.28	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.27	20.28	20.29	20.29	20.29	20.28	20.28	20.27	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.7	0.48	0.32	0.36	0.63	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.31	19.49	19.78	20.1	20.25	20.29	20.29	20.29	20.27	20.07	19.65	19.3	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.71	19.86	20.11	20.4	20.54	20.57	20.57	20.57	20.56	20.37	20	19.69	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.71	19.86	20.11	20.4	20.54	20.57	20.57	20.57	20.56	20.37	20	19.69	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.89	0.71	0.5	0.35	0.39	0.65	0.92	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	446.38	493.65	537.87	546.88	468	320.82	214.18	224.22	343.86	434.86	429.1	426.92	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	871.86	843.21	764.13	633.27	484.74	322	214.26	224.38	350.6	536.11	712.94	862.65	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	316.55	234.91	168.34	62.21	12.46	0	0	0	0	75.33	204.37	324.19	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1398.35 (98)

Space heating requirement in kWh/m²/year 19.69 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	316.55	234.91	168.34	62.21	12.46	0	0	0	0	75.33	204.37	324.19	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	338.56	251.24	180.05	66.53	13.32	0	0	0	0	80.57	218.57	346.72	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1495.56 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

190.36	167.83	176.35	158.21	155.14	138.76	133.39	146.19	145.88	164.05	173.31	185.83

Efficiency of water heater 79.8 (216)

(217)m=	86.16	85.71	84.69	82.55	80.51	79.8	79.8	79.8	79.8	82.88	85.25	86.28	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	220.94	195.81	208.23	191.65	192.7	173.88	167.15	183.2	182.81	197.93	203.28	215.37

Total = Sum(219a)$_{1...12}$ = 2332.94 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1495.56	
Water heating fuel used			2332.94	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			343.11	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	323.04	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	503.91	(264)
Space and water heating	(261) + (262) + (263) + (264) =				826.96	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	178.07	(268)
Total CO2, kg/year			sum of (265)…(271) =		1043.96	(272)

TER = 14.7 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-6-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.5	(1a) x	2.4	(2a) =	178.8	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	178.8	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 2			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	39.17	17.25	21.92	x	0.18	=	3.95			(29)
Walls Type2	5.47	2.1	3.37	x	0.18	=	0.61			(29)
Total area of elements, m²			44.64							(31)
Party wall			51.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 26.82 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.57 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 37.4 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	

Average = Sum(39)$_{1…12}$ /12= 66.9 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9

Average = Sum(40)$_{1…12}$ /12= 0.9 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.02 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	99.02	95.42	91.82	88.22	84.62	81.02	81.02	84.62	88.22	91.82	95.42	99.02

Total = Sum(44)$_{1…12}$ = 1080.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.84	128.43	132.53	115.54	110.87	95.67	88.65	101.73	102.94	119.97	130.96	142.21

Total = Sum(45)$_{1…12}$ = 1416.34 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.03	19.26	19.88	17.33	16.63	14.35	13.3	15.26	15.44	18	19.64	21.33	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.12	178.36	187.81	169.04	166.14	149.16	143.93	157	156.44	175.25	184.45	197.49	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.12	178.36	187.81	169.04	166.14	149.16	143.93	157	156.44	175.25	184.45	197.49	

Output from water heater (annual)$_{1...12}$	2067.18	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.05	82.65	88.29	81.21	81.08	74.6	73.7	78.05	77.02	84.11	86.34	91.51	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.5	16.44	13.37	10.12	7.56	6.39	6.9	8.97	12.04	15.29	17.84	19.02	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	207.56	209.72	204.29	192.74	178.15	164.44	155.28	153.13	158.56	170.11	184.7	198.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	(71)

Water heating gains (Table 5)

(72)m=	125.06	122.98	118.67	112.8	108.98	103.62	99.06	104.9	106.98	113.05	119.91	122.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	409.39	407.39	394.58	373.9	352.95	332.7	319.49	325.25	335.83	356.7	380.71	398.67	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)

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North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)

West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	73.82	143.33	238.41	359.1	455.14	473.73	447.72	373.65	280.31	170.24	91.72	60.97	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	483.2	550.72	632.99	733.01	808.09	806.42	767.21	698.9	616.14	526.94	472.43	459.64	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.73	0.53	0.38	0.44	0.71	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.3	20.53	20.8	20.96	20.99	21	21	20.97	20.74	20.39	20.12	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.87	0.68	0.46	0.31	0.36	0.64	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.25	19.58	19.95	20.13	20.17	20.17	20.17	20.15	19.88	19.38	18.99	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.67	19.96	20.29	20.46	20.5	20.5	20.5	20.48	20.22	19.79	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.67	19.96	20.29	20.46	20.5	20.5	20.5	20.48	20.22	19.79	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.88	0.69	0.49	0.34	0.39	0.67	0.93	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	480.58	543.94	609.66	642.34	561.24	392.03	260.75	273.8	411.88	490.33	466.65	457.76	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1016.29	987.94	900.61	761.9	586.01	394.52	260.98	274.32	426.59	643.78	848.63	1019.62	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	398.57	298.37	216.47	86.08	18.42	0	0	0	0	114.16	275.03	418.02

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1825.12	(98)
Space heating requirement in kWh/m²/year	24.5	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1825.12	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1916.38	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2067.18	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2170.54	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	40.87	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		48.21	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	48.21	(331)

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Energy for lighting (calculated in Appendix L)				326.8	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22 =	949.22	(367)
Electrical energy for heat distribution	[(313) x		0.52 =	21.21	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	970.43	(373)
CO2 associated with space heating (secondary)	(309) x		0 =	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22 =	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			970.43	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52 =	25.02	(378)
CO2 associated with electricity for lighting	(332))) x		0.52 =	169.61	(379)
Total CO2, kg/year	sum of (376)…(382) =			1165.06	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.64	(384)
EI rating (section 14)				86.94	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-6-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.5	(1a) x	2.4	(2a) =	178.8	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	178.8	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.41	x1/[1/(1.4)+ 0.04]		=	5.85			(27)
Windows Type 2			5.07	x1/[1/(1.4)+ 0.04]		=	6.72			(27)
Windows Type 3			2.64	x1/[1/(1.4)+ 0.04]		=	3.5			(27)
Windows Type 4			2.64	x1/[1/(1.4)+ 0.04]		=	3.5			(27)
Windows Type 5			1.76	x1/[1/(1.4)+ 0.04]		=	2.33			(27)
Walls Type1	39.17	16.52	22.65	x	0.18	=	4.08			(29)
Walls Type2	5.47	2.1	3.37	x	0.18	=	0.61			(29)
Total area of elements, m²			44.64							(31)
Party wall			51.4	x	0	=	0			(32)

* *for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
** *include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.69 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.66 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 33.34 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(38)m=	35.55	35.32	35.09	34	33.8	32.86	32.86	32.69	33.22	33.8	34.21	34.64	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	68.89	68.66	68.43	67.35	67.14	66.2	66.2	66.03	66.56	67.14	67.55	67.98	

Average = $Sum(39)_{1...12}$ /12= 67.34 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.92	0.92	0.92	0.9	0.9	0.89	0.89	0.89	0.89	0.9	0.91	0.91	

Average = $Sum(40)_{1...12}$ /12= 0.9 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.02 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	99.02	95.42	91.82	88.22	84.62	81.02	81.02	84.62	88.22	91.82	95.42	99.02	

Total = $Sum(44)_{1...12}$ = 1080.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.84	128.43	132.53	115.54	110.87	95.67	88.65	101.73	102.94	119.97	130.96	142.21	

Total = $Sum(45)_{1...12}$ = 1416.34 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.03	19.26	19.88	17.33	16.63	14.35	13.3	15.26	15.44	18	19.64	21.33	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	193.44	170.52	179.12	160.63	157.46	140.76	135.25	148.32	148.03	166.56	176.05	188.81	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	193.44	170.52	179.12	160.63	157.46	140.76	135.25	148.32	148.03	166.56	176.05	188.81

Output from water heater (annual)$_{1...12}$ | 1964.96 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.1	76.37	81.34	74.49	74.14	67.88	66.75	71.1	70.3	77.17	79.62	84.56	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.51	16.44	13.37	10.12	7.57	6.39	6.9	8.97	12.04	15.29	17.84	19.02	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	207.56	209.72	204.29	192.74	178.15	164.44	155.28	153.13	158.56	170.11	184.7	198.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	(71)

Water heating gains (Table 5)

(72)m=	115.73	113.65	109.33	103.46	99.65	94.28	89.72	95.57	97.64	103.72	110.58	113.66	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	403.05	401.06	388.24	367.57	346.62	326.36	313.16	318.92	329.49	350.37	374.37	392.34	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.07	x	10.63	x	0.63	x	0.7	=	16.48	(74)
North	0.9x	0.77	x	2.64	x	10.63	x	0.63	x	0.7	=	8.58	(74)

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North	0.9x	0.77	x	5.07	x	20.32	x	0.63	x	0.7	=	31.49	(74)
North	0.9x	0.77	x	2.64	x	20.32	x	0.63	x	0.7	=	16.4	(74)
North	0.9x	0.77	x	5.07	x	34.53	x	0.63	x	0.7	=	53.5	(74)
North	0.9x	0.77	x	2.64	x	34.53	x	0.63	x	0.7	=	27.86	(74)
North	0.9x	0.77	x	5.07	x	55.46	x	0.63	x	0.7	=	85.94	(74)
North	0.9x	0.77	x	2.64	x	55.46	x	0.63	x	0.7	=	44.75	(74)
North	0.9x	0.77	x	5.07	x	74.72	x	0.63	x	0.7	=	115.77	(74)
North	0.9x	0.77	x	2.64	x	74.72	x	0.63	x	0.7	=	60.28	(74)
North	0.9x	0.77	x	5.07	x	79.99	x	0.63	x	0.7	=	123.93	(74)
North	0.9x	0.77	x	2.64	x	79.99	x	0.63	x	0.7	=	64.53	(74)
North	0.9x	0.77	x	5.07	x	74.68	x	0.63	x	0.7	=	115.71	(74)
North	0.9x	0.77	x	2.64	x	74.68	x	0.63	x	0.7	=	60.25	(74)
North	0.9x	0.77	x	5.07	x	59.25	x	0.63	x	0.7	=	91.8	(74)
North	0.9x	0.77	x	2.64	x	59.25	x	0.63	x	0.7	=	47.8	(74)
North	0.9x	0.77	x	5.07	x	41.52	x	0.63	x	0.7	=	64.33	(74)
North	0.9x	0.77	x	2.64	x	41.52	x	0.63	x	0.7	=	33.5	(74)
North	0.9x	0.77	x	5.07	x	24.19	x	0.63	x	0.7	=	37.48	(74)
North	0.9x	0.77	x	2.64	x	24.19	x	0.63	x	0.7	=	19.52	(74)
North	0.9x	0.77	x	5.07	x	13.12	x	0.63	x	0.7	=	20.33	(74)
North	0.9x	0.77	x	2.64	x	13.12	x	0.63	x	0.7	=	10.58	(74)
North	0.9x	0.77	x	5.07	x	8.86	x	0.63	x	0.7	=	13.74	(74)
North	0.9x	0.77	x	2.64	x	8.86	x	0.63	x	0.7	=	7.15	(74)
West	0.9x	0.77	x	4.41	x	19.64	x	0.63	x	0.7	=	26.47	(80)
West	0.9x	0.77	x	2.64	x	19.64	x	0.63	x	0.7	=	15.85	(80)
West	0.9x	0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(80)
West	0.9x	0.77	x	4.41	x	38.42	x	0.63	x	0.7	=	51.78	(80)
West	0.9x	0.77	x	2.64	x	38.42	x	0.63	x	0.7	=	31	(80)
West	0.9x	0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(80)
West	0.9x	0.77	x	4.41	x	63.27	x	0.63	x	0.7	=	85.28	(80)
West	0.9x	0.77	x	2.64	x	63.27	x	0.63	x	0.7	=	51.05	(80)
West	0.9x	0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(80)
West	0.9x	0.77	x	4.41	x	92.28	x	0.63	x	0.7	=	124.37	(80)
West	0.9x	0.77	x	2.64	x	92.28	x	0.63	x	0.7	=	74.45	(80)
West	0.9x	0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(80)
West	0.9x	0.77	x	4.41	x	113.09	x	0.63	x	0.7	=	152.42	(80)
West	0.9x	0.77	x	2.64	x	113.09	x	0.63	x	0.7	=	91.25	(80)
West	0.9x	0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(80)
West	0.9x	0.77	x	4.41	x	115.77	x	0.63	x	0.7	=	156.03	(80)
West	0.9x	0.77	x	2.64	x	115.77	x	0.63	x	0.7	=	93.41	(80)
West	0.9x	0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(80)
West	0.9x	0.77	x	4.41	x	110.22	x	0.63	x	0.7	=	148.55	(80)

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West	0.9x	0.77	x	2.64	x	110.22	x	0.63	x	0.7	=	88.93	(80)
West	0.9x	0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(80)
West	0.9x	0.77	x	4.41	x	94.68	x	0.63	x	0.7	=	127.6	(80)
West	0.9x	0.77	x	2.64	x	94.68	x	0.63	x	0.7	=	76.39	(80)
West	0.9x	0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(80)
West	0.9x	0.77	x	4.41	x	73.59	x	0.63	x	0.7	=	99.18	(80)
West	0.9x	0.77	x	2.64	x	73.59	x	0.63	x	0.7	=	59.37	(80)
West	0.9x	0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(80)
West	0.9x	0.77	x	4.41	x	45.59	x	0.63	x	0.7	=	61.44	(80)
West	0.9x	0.77	x	2.64	x	45.59	x	0.63	x	0.7	=	36.78	(80)
West	0.9x	0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(80)
West	0.9x	0.77	x	4.41	x	24.49	x	0.63	x	0.7	=	33.01	(80)
West	0.9x	0.77	x	2.64	x	24.49	x	0.63	x	0.7	=	19.76	(80)
West	0.9x	0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(80)
West	0.9x	0.77	x	4.41	x	16.15	x	0.63	x	0.7	=	21.77	(80)
West	0.9x	0.77	x	2.64	x	16.15	x	0.63	x	0.7	=	13.03	(80)
West	0.9x	0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	77.94	151.33	251.72	379.15	480.55	500.17	472.72	394.51	295.96	179.74	96.84	64.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	480.99	552.38	639.96	746.72	827.16	826.54	785.87	713.43	625.45	530.11	471.22	456.71	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.89	0.72	0.51	0.37	0.42	0.7	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.12	20.27	20.51	20.81	20.96	21	21	21	20.97	20.74	20.38	20.1	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.16	20.17	20.18	20.18	20.18	20.17	20.17	20.16	20.16	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.87	0.66	0.45	0.3	0.35	0.63	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.19	19.54	19.95	20.13	20.17	20.18	20.18	20.15	19.88	19.36	18.94	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.43	19.62	19.93	20.29	20.46	20.5	20.51	20.51	20.48	20.22	19.77	19.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.43	19.62	19.93	20.29	20.46	20.5	20.51	20.51	20.48	20.22	19.77	19.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=	0.99	0.99	0.96	0.87	0.68	0.47	0.33	0.38	0.66	0.93	0.99	1		(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	478.49	545.7	616.28	650.32	565.25	388.81	258.41	270.75	411.48	492.75	465.59	454.92		(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1042.15	1010.51	919.05	767.15	588.25	390.79	258.58	271.16	424.77	646.06	855.64	1033.55		(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	419.37	312.35	225.26	84.11	17.11	0	0	0	0	114.06	280.84	430.5		

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1883.6 (98)

Space heating requirement in kWh/m²/year 25.28 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	419.37	312.35	225.26	84.11	17.11	0	0	0	0	114.06	280.84	430.5		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	448.52	334.06	240.92	89.96	18.3	0	0	0	0	121.99	300.36	460.43		

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2014.55 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	193.44	170.52	179.12	160.63	157.46	140.76	135.25	148.32	148.03	166.56	176.05	188.81	

Efficiency of water heater 79.8 (216)

(217)m=	86.83	86.41	85.43	83.18	80.74	79.8	79.8	79.8	79.8	83.83	86.05	86.95	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	222.79	197.34	209.68	193.12	195.03	176.39	169.48	185.87	185.51	198.7	204.58	217.15

Total = Sum(219a)$_{1...12}$ = 2355.64 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2014.55
Water heating fuel used		2355.64
Electricity for pumps, fans and electric keep-hot		

central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			326.83	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	435.14	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	508.82	(264)
Space and water heating	(261) + (262) + (263) + (264) =			943.96	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	169.63	(268)
Total CO2, kg/year		sum of (265)…(271) =		1152.51	(272)

TER = 15.47 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-8-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.18	(1a) x	2.4	(2a) =	170.83	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.18	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.83	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 2			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 4			8.05	x1/[1/(1.2)+ 0.04]		=	9.22			(27)
Walls Type1	39.96	17.02	22.94	x	0.18	=	4.13			(29)
Walls Type2	5.87	2.1	3.77	x	0.18	=	0.68			(29)
Roof	71.18	0	71.18	x	0.11	=	7.83			(30)
Total area of elements, m²			117.01							(31)
Party wall			39.46	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	34.65	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		14.05	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	48.7	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.88	76.88	76.88	76.88	76.88	76.88	76.88	76.88	76.88	76.88	76.88	76.88	

Average = $Sum(39)_{1…12}$ /12= 76.88 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08

Average = $Sum(40)_{1…12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.27 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	97.04	93.51	89.98	86.45	82.92	79.4	79.4	82.92	86.45	89.98	93.51	97.04	

Total = $Sum(44)_{1…12}$ = 1058.61 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.91	125.86	129.88	113.23	108.65	93.75	86.88	99.69	100.88	117.57	128.34	139.37

Total = $Sum(45)_{1…12}$ = 1388.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.59	18.88	19.48	16.98	16.3	14.06	13.03	14.95	15.13	17.64	19.25	20.9	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3												0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.18	175.79	185.15	166.72	163.92	147.25	142.15	154.97	154.38	172.85	181.83	194.64	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.18	175.79	185.15	166.72	163.92	147.25	142.15	154.97	154.38	172.85	181.83	194.64	
Output from water heater (annual)1…12												2038.85	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.07	81.79	87.41	80.44	80.35	73.97	73.11	77.37	76.34	83.31	85.47	90.56	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.83	15.84	12.88	9.75	7.29	6.15	6.65	8.64	11.6	14.73	17.19	18.33	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.04	202.11	196.88	185.74	171.69	158.48	149.65	147.57	152.81	163.94	178	191.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	(71)

Water heating gains (Table 5)

(72)m=	123.75	121.71	117.48	111.73	107.99	102.73	98.26	103.99	106.03	111.98	118.7	121.72	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	398.74	396.78	384.36	364.34	344.09	324.48	311.68	317.33	327.55	347.77	371.01	388.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)

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North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
East	0.9x	1	x	8.05	x	19.64	x	0.5	x	0.8	=	43.83	(76)
East	0.9x	1	x	8.05	x	38.42	x	0.5	x	0.8	=	85.73	(76)
East	0.9x	1	x	8.05	x	63.27	x	0.5	x	0.8	=	141.19	(76)
East	0.9x	1	x	8.05	x	92.28	x	0.5	x	0.8	=	205.92	(76)
East	0.9x	1	x	8.05	x	113.09	x	0.5	x	0.8	=	252.36	(76)
East	0.9x	1	x	8.05	x	115.77	x	0.5	x	0.8	=	258.34	(76)
East	0.9x	1	x	8.05	x	110.22	x	0.5	x	0.8	=	245.95	(76)

East	0.9x	1	x	8.05	x	94.68	x	0.5	x	0.8	=	211.27	(76)
East	0.9x	1	x	8.05	x	73.59	x	0.5	x	0.8	=	164.21	(76)
East	0.9x	1	x	8.05	x	45.59	x	0.5	x	0.8	=	101.73	(76)
East	0.9x	1	x	8.05	x	24.49	x	0.5	x	0.8	=	54.65	(76)
East	0.9x	1	x	8.05	x	16.15	x	0.5	x	0.8	=	36.04	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	70.27	136.26	227.05	343.83	438.14	457.22	431.63	358.58	267.44	161.88	87.26	58.08	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	469	533.04	611.41	708.17	782.23	781.7	743.31	675.91	594.99	509.65	458.28	446.46	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.8	0.61	0.45	0.51	0.79	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.91	20.05	20.31	20.64	20.88	20.98	21	20.99	20.92	20.59	20.18	19.87	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.75	0.52	0.35	0.41	0.71	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.57	18.78	19.15	19.6	19.91	20	20.02	20.01	19.95	19.55	18.96	18.51	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.1	19.29	19.61	20.02	20.3	20.39	20.41	20.41	20.34	19.96	19.45	19.05	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.1	19.29	19.61	20.02	20.3	20.39	20.41	20.41	20.34	19.96	19.45	19.05	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.76	0.56	0.39	0.45	0.74	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	466.45	527.16	593.54	643.39	596.57	435.29	291.47	305.3	439.61	482.57	453.18	444.55	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1138.1	1106.11	1008.22	854.72	660.97	445.38	292.76	307.95	479.77	719.82	949.44	1141.88	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	499.71	389.06	308.53	152.16	47.91	0	0	0	0	176.51	357.31	518.81	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 2450 (98)

Space heating requirement in kWh/m²/year 34.42 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.			
Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2450	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2572.5	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2038.85	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2140.79	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	47.13	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.06	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	46.06	(331)
Energy for lighting (calculated in Appendix L)		314.94	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1094.7	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	24.46	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1119.16	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1119.16	(376)

CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	23.9	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	163.45	(379)
Total CO2, kg/year	sum of (376)…(382) =			1306.52	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.36	(384)
EI rating (section 14)				84.93	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-8-01

Address :	Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.18	(1a) x	2.4	(2a) =	170.83	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.18	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.83	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.43	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.7	x1/[1/(1.4)+ 0.04]		=	2.25			(27)
Windows Type 2			4.88	x1/[1/(1.4)+ 0.04]		=	6.47			(27)
Windows Type 3			1.7	x1/[1/(1.4)+ 0.04]		=	2.25			(27)
Windows Type 4			7.42	x1/[1/(1.4)+ 0.04]		=	9.84			(27)
Walls Type1	39.96	15.7	24.26	x	0.18	=	4.37			(29)
Walls Type2	5.87	2.1	3.77	x	0.18	=	0.68			(29)
Roof	71.18	0	71.18	x	0.13	=	9.25			(30)
Total area of elements, m²			117.01							(31)
Party wall			39.46	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.21 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.18 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 43.39 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(38)m=	34.18	33.95	33.72	32.65	32.45	31.52	31.52	31.34	31.88	32.45	32.86	33.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	77.57	77.34	77.11	76.04	75.84	74.91	74.91	74.73	75.27	75.84	76.25	76.67	

Average = Sum(39)$_{1…12}$ /12= 76.04 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.09	1.09	1.08	1.07	1.07	1.05	1.05	1.05	1.06	1.07	1.07	1.08	

Average = Sum(40)$_{1…12}$ /12= 1.07 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.27 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	97.04	93.51	89.98	86.45	82.92	79.4	79.4	82.92	86.45	89.98	93.51	97.04	

Total = Sum(44)$_{1…12}$ = 1058.61 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.91	125.86	129.88	113.23	108.65	93.75	86.88	99.69	100.88	117.57	128.34	139.37	

Total = Sum(45)$_{1…12}$ = 1388.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.59	18.88	19.48	16.98	16.3	14.06	13.03	14.95	15.13	17.64	19.25	20.9	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	190.5	167.95	176.47	158.32	155.24	138.85	133.47	146.29	145.98	164.17	173.43	185.96	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	190.5	167.95	176.47	158.32	155.24	138.85	133.47	146.29	145.98	164.17	173.43	185.96

Output from water heater (annual)$_{1...12}$ | 1936.62 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.12	75.52	80.46	73.72	73.4	67.25	66.16	70.42	69.62	76.37	78.75	83.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.84	15.84	12.88	9.75	7.29	6.16	6.65	8.65	11.6	14.74	17.2	18.33	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.04	202.11	196.88	185.74	171.69	158.48	149.65	147.57	152.81	163.94	178	191.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	(71)

Water heating gains (Table 5)

(72)m=	114.42	112.38	108.15	102.39	98.66	93.4	88.93	94.66	96.69	102.65	109.37	112.39	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	392.4	390.45	378.03	358.01	337.75	318.15	305.35	310.99	321.22	341.44	364.68	382.05	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.7	x	10.63	x	0.63	x	0.7	=	5.52	(74)
North	0.9x	0.77	x	4.88	x	10.63	x	0.63	x	0.7	=	15.86	(74)

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North	0.9x	0.77	x	1.7	x	10.63	x	0.63	x	0.7	=	5.52	(74)
North	0.9x	0.77	x	1.7	x	20.32	x	0.63	x	0.7	=	10.56	(74)
North	0.9x	0.77	x	4.88	x	20.32	x	0.63	x	0.7	=	30.31	(74)
North	0.9x	0.77	x	1.7	x	20.32	x	0.63	x	0.7	=	10.56	(74)
North	0.9x	0.77	x	1.7	x	34.53	x	0.63	x	0.7	=	17.94	(74)
North	0.9x	0.77	x	4.88	x	34.53	x	0.63	x	0.7	=	51.5	(74)
North	0.9x	0.77	x	1.7	x	34.53	x	0.63	x	0.7	=	17.94	(74)
North	0.9x	0.77	x	1.7	x	55.46	x	0.63	x	0.7	=	28.82	(74)
North	0.9x	0.77	x	4.88	x	55.46	x	0.63	x	0.7	=	82.72	(74)
North	0.9x	0.77	x	1.7	x	55.46	x	0.63	x	0.7	=	28.82	(74)
North	0.9x	0.77	x	1.7	x	74.72	x	0.63	x	0.7	=	38.82	(74)
North	0.9x	0.77	x	4.88	x	74.72	x	0.63	x	0.7	=	111.43	(74)
North	0.9x	0.77	x	1.7	x	74.72	x	0.63	x	0.7	=	38.82	(74)
North	0.9x	0.77	x	1.7	x	79.99	x	0.63	x	0.7	=	41.56	(74)
North	0.9x	0.77	x	4.88	x	79.99	x	0.63	x	0.7	=	119.29	(74)
North	0.9x	0.77	x	1.7	x	79.99	x	0.63	x	0.7	=	41.56	(74)
North	0.9x	0.77	x	1.7	x	74.68	x	0.63	x	0.7	=	38.8	(74)
North	0.9x	0.77	x	4.88	x	74.68	x	0.63	x	0.7	=	111.37	(74)
North	0.9x	0.77	x	1.7	x	74.68	x	0.63	x	0.7	=	38.8	(74)
North	0.9x	0.77	x	1.7	x	59.25	x	0.63	x	0.7	=	30.78	(74)
North	0.9x	0.77	x	4.88	x	59.25	x	0.63	x	0.7	=	88.36	(74)
North	0.9x	0.77	x	1.7	x	59.25	x	0.63	x	0.7	=	30.78	(74)
North	0.9x	0.77	x	1.7	x	41.52	x	0.63	x	0.7	=	21.57	(74)
North	0.9x	0.77	x	4.88	x	41.52	x	0.63	x	0.7	=	61.92	(74)
North	0.9x	0.77	x	1.7	x	41.52	x	0.63	x	0.7	=	21.57	(74)
North	0.9x	0.77	x	1.7	x	24.19	x	0.63	x	0.7	=	12.57	(74)
North	0.9x	0.77	x	4.88	x	24.19	x	0.63	x	0.7	=	36.08	(74)
North	0.9x	0.77	x	1.7	x	24.19	x	0.63	x	0.7	=	12.57	(74)
North	0.9x	0.77	x	1.7	x	13.12	x	0.63	x	0.7	=	6.82	(74)
North	0.9x	0.77	x	4.88	x	13.12	x	0.63	x	0.7	=	19.56	(74)
North	0.9x	0.77	x	1.7	x	13.12	x	0.63	x	0.7	=	6.82	(74)
North	0.9x	0.77	x	1.7	x	8.86	x	0.63	x	0.7	=	4.61	(74)
North	0.9x	0.77	x	4.88	x	8.86	x	0.63	x	0.7	=	13.22	(74)
North	0.9x	0.77	x	1.7	x	8.86	x	0.63	x	0.7	=	4.61	(74)
East	0.9x	1	x	7.42	x	19.64	x	0.63	x	0.7	=	44.54	(76)
East	0.9x	1	x	7.42	x	38.42	x	0.63	x	0.7	=	87.12	(76)
East	0.9x	1	x	7.42	x	63.27	x	0.63	x	0.7	=	143.48	(76)
East	0.9x	1	x	7.42	x	92.28	x	0.63	x	0.7	=	209.26	(76)
East	0.9x	1	x	7.42	x	113.09	x	0.63	x	0.7	=	256.45	(76)
East	0.9x	1	x	7.42	x	115.77	x	0.63	x	0.7	=	262.53	(76)
East	0.9x	1	x	7.42	x	110.22	x	0.63	x	0.7	=	249.94	(76)

East	0.9x	1	x	7.42	x	94.68	x	0.63	x	0.7	=	214.69	(76)
East	0.9x	1	x	7.42	x	73.59	x	0.63	x	0.7	=	166.87	(76)
East	0.9x	1	x	7.42	x	45.59	x	0.63	x	0.7	=	103.38	(76)
East	0.9x	1	x	7.42	x	24.49	x	0.63	x	0.7	=	55.53	(76)
East	0.9x	1	x	7.42	x	16.15	x	0.63	x	0.7	=	36.63	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	71.44	138.55	230.86	349.61	445.52	464.93	438.9	364.61	271.93	164.59	88.73	59.06	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	463.85	528.99	608.89	707.62	783.27	783.07	744.25	675.61	593.15	506.03	453.41	441.1	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.8	0.59	0.44	0.5	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.89	20.04	20.3	20.65	20.89	20.98	21	20.99	20.93	20.6	20.18	19.87	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.01	20.01	20.01	20.03	20.03	20.04	20.04	20.04	20.04	20.03	20.02	20.02	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.74	0.51	0.35	0.4	0.7	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.53	18.75	19.14	19.63	19.93	20.03	20.04	20.04	19.98	19.57	18.97	18.51	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.07	19.27	19.6	20.04	20.31	20.41	20.42	20.42	20.36	19.98	19.46	19.05	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.07	19.27	19.6	20.04	20.31	20.41	20.42	20.42	20.36	19.98	19.46	19.05	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.76	0.55	0.38	0.44	0.73	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	461.45	523.36	591.42	641.89	593.09	426.88	285.28	298.43	434.57	479.29	448.56	439.32	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1146.07	1111.16	1010.47	846.72	653.13	435.18	286.3	300.53	471	711.32	942.23	1138.52	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	509.36	395.01	311.77	147.47	44.67	0	0	0	0	172.63	355.44	520.21	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = | 2456.56 | (98)

Space heating requirement in kWh/m²/year | 34.51 | (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	509.36	395.01	311.77	147.47	44.67	0	0	0	0	172.63	355.44	520.21		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	544.77	422.47	333.45	157.73	47.78	0	0	0	0	184.63	380.15	556.37		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													2627.34	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)
Water heating														
Output from water heater (calculated above)	190.5	167.95	176.47	158.32	155.24	138.85	133.47	146.29	145.98	164.17	173.43	185.96		
Efficiency of water heater													79.8	(216)
(217)m=	87.31	87.02	86.32	84.63	81.97	79.8	79.8	79.8	79.8	84.95	86.69	87.41		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	218.18	193	204.45	187.09	189.4	173.99	167.26	183.32	182.93	193.25	200.06	212.74		
Total = Sum(219a)$_{1...12}$ =													2305.67	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2627.34	
Water heating fuel used			2305.67	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			315.03	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	567.51	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	498.02	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1065.53	(265)

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Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	163.5	(268)
Total CO2, kg/year			sum of (265)…(271) =		1267.95	(272)

TER =	17.81	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-8-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.42	(1a) x	2.4	(2a) =	171.41	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.42	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.41	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*			0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Walls Type1	28.74	10.12	18.62	x	0.18	=	3.35			(29)
Walls Type2	43.06	2.1	40.96	x	0.18	=	7.37			(29)
Roof	17.74	0	17.74	x	0.11	=	1.95			(30)
Total area of elements, m²			89.54							(31)
Party wall			14.79	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	26.78	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		13.15	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	39.93	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	

Average = Sum(39)$_{1\ldots12}$ /12= 68.21 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	

Average = Sum(40)$_{1…12}$ /12= 0.96 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.28 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	97.19	93.65	90.12	86.59	83.05	79.52	79.52	83.05	86.59	90.12	93.65	97.19	

Total = Sum(44)$_{1…12}$ = 1060.23 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	144.13	126.05	130.08	113.4	108.81	93.9	87.01	99.85	101.04	117.75	128.53	139.58	

Total = Sum(45)$_{1…12}$ = 1390.13 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	21.62	18.91	19.51	17.01	16.32	14.08	13.05	14.98	15.16	17.66	19.28	20.94	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.4	175.98	185.35	166.9	164.09	147.39	142.29	155.12	154.53	173.03	182.03	194.86	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.4	175.98	185.35	166.9	164.09	147.39	142.29	155.12	154.53	173.03	182.03	194.86	

Output from water heater (annual)$_{1...12}$ 2040.97 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.14	81.85	87.47	80.5	80.4	74.02	73.15	77.42	76.39	83.37	85.53	90.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114	114	114	114	114	114	114	114	114	114	114	114	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	18.61	16.53	13.44	10.18	7.61	6.42	6.94	9.02	12.11	15.37	17.94	19.13	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	200.59	202.67	197.42	186.26	172.16	158.91	150.06	147.98	153.23	164.39	178.49	191.74	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	(71)
Water heating gains (Table 5)													
(72)m=	123.85	121.81	117.57	111.81	108.07	102.8	98.32	104.06	106.1	112.06	118.79	121.82	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	400.25	398.21	385.64	365.45	345.04	325.34	312.53	318.26	328.64	349.03	372.43	389.89	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)

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East	0.9x	1	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	55.1	107.78	177.5	258.87	317.25	324.77	309.19	265.59	206.44	127.89	68.7	45.31	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	455.35	505.99	563.14	624.32	662.29	650.11	621.72	583.86	535.07	476.92	441.13	435.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.83	0.65	0.48	0.53	0.79	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.07	20.19	20.41	20.68	20.89	20.98	21	20.99	20.94	20.66	20.31	20.03	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.79	0.57	0.39	0.43	0.72	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.87	19.05	19.37	19.75	20.01	20.11	20.12	20.12	20.07	19.73	19.22	18.82	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.51	19.78	20.12	20.36	20.46	20.47	20.47	20.42	20.1	19.65	19.3	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.51	19.78	20.12	20.36	20.46	20.47	20.47	20.42	20.1	19.65	19.3	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.8	0.6	0.42	0.47	0.75	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	453.15	501.21	549.39	577.81	530.66	390.22	263.01	275.67	400.37	453.04	436.66	433.56	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1026.57	996.29	906.01	765.3	591.03	399.49	264.03	277.57	431	648.14	856.38	1030.24	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	426.62	332.7	265.32	134.99	44.92	0	0	0	0	145.16	302.2	443.93	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2095.83 (98)

Space heating requirement in kWh/m²/year 29.35 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2095.83	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2200.63	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308

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Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2040.97	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2143.01	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.44	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.22	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	46.22	(331)
Energy for lighting (calculated in Appendix L)		328.7	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1008.85	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	22.54	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1031.39	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1031.39	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	23.99	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	170.6	(379)
Total CO2, kg/year	sum of (376)…(382) =				1225.97	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17.17	(384)
EI rating (section 14)					85.89	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-8-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.42	(1a) x	2.4	(2a) =	171.41	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.42	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.41	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.43	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Walls Type1	28.74	10.12	18.62	x	0.18	=	3.35			(29)
Walls Type2	43.06	2.1	40.96	x	0.18	=	7.37			(29)
Roof	17.74	0	17.74	x	0.13	=	2.31			(30)
Total area of elements, m²			89.54							(31)
Party wall			14.79	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.55 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.24 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 36.79 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.28	34.05	33.82	32.75	32.55	31.61	31.61	31.44	31.97	32.55	32.95	33.38	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	71.07	70.84	70.61	69.53	69.33	68.4	68.4	68.23	68.76	69.33	69.74	70.16	

Average = Sum(39)$_{1…12}$ /12= 69.53 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	0.99	0.99	0.97	0.97	0.96	0.96	0.96	0.96	0.97	0.98	0.98

Average = Sum(40)$_{1…12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.28 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.19	93.65	90.12	86.59	83.05	79.52	79.52	83.05	86.59	90.12	93.65	97.19

Total = Sum(44)$_{1…12}$ = 1060.23 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.13	126.05	130.08	113.4	108.81	93.9	87.01	99.85	101.04	117.75	128.53	139.58

Total = Sum(45)$_{1…12}$ = 1390.13 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.62	18.91	19.51	17.01	16.32	14.08	13.05	14.98	15.16	17.66	19.28	20.94	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	190.72	168.14	176.67	158.5	155.41	138.99	133.61	146.44	146.13	164.34	173.63	186.17	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	190.72	168.14	176.67	158.5	155.41	138.99	133.61	146.44	146.13	164.34	173.63	186.17	

Output from water heater (annual)$_{1...12}$ 1938.74 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.2	75.58	80.53	73.78	73.46	67.29	66.21	70.47	69.67	76.43	78.81	83.69	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114	114	114	114	114	114	114	114	114	114	114	114	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	19.13	17	13.82	10.46	7.82	6.6	7.14	9.27	12.45	15.81	18.45	19.67	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	200.59	202.67	197.42	186.26	172.16	158.91	150.06	147.98	153.23	164.39	178.49	191.74	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	(71)
Water heating gains (Table 5)													
(72)m=	114.51	112.47	108.23	102.47	98.73	93.46	88.99	94.72	96.76	102.73	109.46	112.48	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	394.44	392.34	379.68	359.4	338.92	319.18	306.39	312.18	322.64	343.13	366.6	384.09	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)

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East	0.9x	1	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	60.74	118.83	195.69	285.4	349.77	358.06	340.88	292.81	227.6	141	75.74	49.95	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	455.18	511.17	575.37	644.8	688.69	677.24	647.27	605	550.24	484.13	442.34	434.04	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.82	0.63	0.46	0.51	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.01	20.14	20.38	20.68	20.89	20.98	21	21	20.94	20.65	20.28	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.09	20.09	20.09	20.11	20.11	20.12	20.12	20.12	20.11	20.11	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.77	0.55	0.37	0.42	0.71	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.76	18.96	19.3	19.73	20.01	20.11	20.12	20.12	20.07	19.71	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.26	19.43	19.73	20.11	20.36	20.46	20.47	20.47	20.42	20.09	19.62	19.24	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.26	19.43	19.73	20.11	20.36	20.46	20.47	20.47	20.42	20.09	19.62	19.24	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.92	0.79	0.58	0.41	0.46	0.74	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	453.02	506.26	560.75	593.08	542.82	392.78	263.83	276.06	405.44	459.19	437.89	432.44	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1063.25	1029.58	934.43	779.68	600.55	400.65	264.68	277.65	434.4	657.82	872.82	1055.31	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	454.01	351.67	278.02	134.35	42.95	0	0	0	0	147.78	313.15	463.42	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2185.35 (98)

Space heating requirement in kWh/m²/year 30.6 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	454.01	351.67	278.02	134.35	42.95	0	0	0	0	147.78	313.15	463.42	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	485.57	376.12	297.35	143.69	45.93	0	0	0	0	158.05	334.92	495.63	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2337.27 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

190.72	168.14	176.67	158.5	155.41	138.99	133.61	146.44	146.13	164.34	173.63	186.17

Efficiency of water heater 79.8 (216)

(217)m=	87.05	86.74	86.02	84.38	81.9	79.8	79.8	79.8	79.8	84.53	86.37	87.15	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	219.1	193.85	205.39	187.84	189.76	174.17	167.42	183.51	183.12	194.42	201.03	213.62

Total = Sum(219a)$_{1...12}$ = 2313.23 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2337.27	
Water heating fuel used		2313.23	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		337.92	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	504.85	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	499.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1004.51	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	175.38	(268)
Total CO2, kg/year		sum of (265)…(271) =		1218.82	(272)

TER = 17.07 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-8-06

Address :	Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.03	(1a) x	2.4	(2a) =	170.47	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.03	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		170.47	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Walls Type1	25.33	9.2	16.13	x	0.18	=	2.9			(29)
Walls Type2	13.71	2.1	11.61	x	0.18	=	2.09			(29)
Roof	10.34	0	10.34	x	0.11	=	1.14			(30)
Total area of elements, m²			49.38							(31)
Party wall			52.54	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.18 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 16.21 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 35.4 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	63.52	63.52	63.52	63.52	63.52	63.52	63.52	63.52	63.52	63.52	63.52	63.52	

Average = Sum(39)$_{1…12}$ /12= 63.52 (39)

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Heat loss parameter (HLP), W/m^{2}K (40)m = (39)m ÷ (4)

(40)m=	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89

Average = Sum(40)$_{1…12}$ /12= 0.89 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.27 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	96.95	93.42	89.9	86.37	82.85	79.32	79.32	82.85	86.37	89.9	93.42	96.95

Total = Sum(44)$_{1…12}$ = 1057.6 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.77	125.74	129.75	113.12	108.54	93.66	86.79	99.6	100.79	117.46	128.21	139.23

Total = Sum(45)$_{1…12}$ = 1386.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.57	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.88	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.05	175.67	185.03	166.62	163.82	147.16	142.07	154.87	154.28	172.73	181.71	194.51	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.05	175.67	185.03	166.62	163.82	147.16	142.07	154.87	154.28	172.73	181.71	194.51	

Output from water heater (annual)$_{1...12}$ 2037.52 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.02	81.75	87.36	80.41	80.31	73.94	73.08	77.34	76.31	83.28	85.43	90.52	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.87	16.76	13.63	10.32	7.71	6.51	7.04	9.15	12.28	15.59	18.19	19.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.69	201.76	196.54	185.42	171.39	158.2	149.39	147.32	152.54	163.66	177.69	190.88	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	(71)

Water heating gains (Table 5)

(72)m=	123.69	121.65	117.43	111.68	107.95	102.69	98.23	103.95	105.98	111.93	118.65	121.66	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	399.31	397.24	384.66	364.48	344.11	324.47	311.72	317.48	327.86	348.24	371.59	389	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)

West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	50.09	97.98	161.36	235.34	288.41	295.24	281.08	241.45	187.67	116.26	62.45	41.19	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	449.4	495.22	546.02	599.82	632.53	619.71	592.8	558.92	515.53	464.5	434.05	430.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.83	0.64	0.47	0.52	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.26	20.47	20.72	20.91	20.98	21	21	20.95	20.7	20.37	20.12	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.78	0.56	0.38	0.43	0.71	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.03	19.2	19.49	19.84	20.08	20.16	20.17	20.17	20.13	19.83	19.36	18.98	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.48	19.63	19.88	20.19	20.41	20.49	20.5	20.5	20.46	20.18	19.77	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.48	19.63	19.88	20.19	20.41	20.49	20.5	20.5	20.46	20.18	19.77	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.8	0.59	0.42	0.46	0.74	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	447.24	490.59	532.79	554.84	504.33	367.49	247.22	259.27	380.6	440.29	429.57	428.59	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	964.32	935.44	850.13	717.43	553.56	374.25	247.88	260.52	404.1	608.6	804.54	967.84	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	384.7	298.94	236.1	117.07	36.63	0	0	0	0	125.22	269.98	401.2	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1869.84 (98)

Space heating requirement in kWh/m²/year 26.32 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1869.84	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1963.33	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308

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Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2037.52	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2139.39	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	41.03	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		45.96	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	45.96	(331)
Energy for lighting (calculated in Appendix L)		333.28	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	952.89	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	21.29	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	974.18	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				974.18	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	23.85	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	172.97	(379)
Total CO2, kg/year	sum of (376)…(382) =				1171.01	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				16.49	(384)
EI rating (section 14)					86.48	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-8-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.03	(1a) x	2.4	(2a) =	170.47	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.03	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.47	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.43	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 3			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Walls Type1	25.33	9.2	16.13	x	0.18	=	2.9			(29)
Walls Type2	13.71	2.1	11.61	x	0.18	=	2.09			(29)
Roof	10.34	0	10.34	x	0.13	=	1.34			(30)
Total area of elements, m²			49.38							(31)
Party wall			52.54	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	20.63	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		5.68	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	26.32	(37)

Ventilation heat loss calculated monthly — (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.12	33.89	33.66	32.59	32.39	31.46	31.46	31.28	31.82	32.39	32.8	33.22	(38)

Heat transfer coefficient, W/K — (39)m = (37) + (38)m

(39)m=	60.44	60.21	59.98	58.91	58.71	57.77	57.77	57.6	58.13	58.71	59.11	59.54	

Average = Sum(39)$_{1…12}$ /12= 58.91 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.85	0.85	0.84	0.83	0.83	0.81	0.81	0.81	0.82	0.83	0.83	0.84

Average = Sum(40)$_{1…12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.27 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	96.95	93.42	89.9	86.37	82.85	79.32	79.32	82.85	86.37	89.9	93.42	96.95	
										Total = Sum(44)$_{1…12}$ =		1057.6	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	143.77	125.74	129.75	113.12	108.54	93.66	86.79	99.6	100.79	117.46	128.21	139.23	
										Total = Sum(45)$_{1…12}$ =		1386.68	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	21.57	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.88	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	190.36	167.83	176.35	158.21	155.14	138.76	133.39	146.19	145.88	164.05	173.31	185.83	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	190.36	167.83	176.35	158.21	155.14	138.76	133.39	146.19	145.88	164.05	173.31	185.83	

Output from water heater (annual)$_{1...12}$ 1935.29 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.08	75.48	80.42	73.69	73.37	67.22	66.13	70.39	69.59	76.33	78.7	83.57	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.43	17.26	14.03	10.62	7.94	6.7	7.24	9.42	12.64	16.05	18.73	19.97	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.69	201.76	196.54	185.42	171.39	158.2	149.39	147.32	152.54	163.66	177.69	190.88	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	(71)

Water heating gains (Table 5)

(72)m=	114.35	112.32	108.09	102.34	98.61	93.36	88.89	94.61	96.65	102.59	109.31	112.33	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	393.53	391.4	378.73	358.45	338.01	318.33	305.59	311.41	321.89	342.36	365.8	383.24	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)

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West	0.9x	0.77	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	55.22	108.02	177.9	259.46	317.98	325.5	309.89	266.19	206.91	128.18	68.85	45.41	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	448.76	499.42	556.63	617.91	655.98	643.83	615.48	577.61	528.8	470.54	434.65	428.65	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.78	0.57	0.41	0.46	0.73	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.34	20.55	20.8	20.95	20.99	21	21	20.98	20.77	20.45	20.2	(87)

TER WorkSheet: New dwelling design stage

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.21	20.21	20.23	20.23	20.24	20.24	20.24	20.24	20.23	20.23	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.73	0.5	0.34	0.38	0.66	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.16	19.34	19.64	20	20.18	20.24	20.24	20.24	20.22	19.97	19.52	19.14	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.58	19.74	20	20.32	20.49	20.54	20.54	20.55	20.52	20.29	19.89	19.56	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.58	19.74	20	20.32	20.49	20.54	20.54	20.55	20.52	20.29	19.89	19.56	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.9	0.75	0.53	0.37	0.41	0.68	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	446.53	494.21	540.33	557.31	489.09	340.82	227.72	238.42	361.69	440.13	429.69	427.02	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	923.48	893.34	809.81	672.63	516.02	343.22	227.9	238.79	373.31	568.96	756.07	914.66	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	354.85	268.21	200.5	83.04	20.03	0	0	0	0	95.85	234.99	362.8	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1620.27 (98)

Space heating requirement in kWh/m²/year 22.81 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	354.85	268.21	200.5	83.04	20.03	0	0	0	0	95.85	234.99	362.8	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	379.51	286.86	214.44	88.81	21.43	0	0	0	0	102.51	251.33	388.02	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1732.91 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

TER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

190.36	167.83	176.35	158.21	155.14	138.76	133.39	146.19	145.88	164.05	173.31	185.83

Efficiency of water heater 79.8 (216)

(217)m=	86.45	86.06	85.16	83.19	80.89	79.8	79.8	79.8	79.8	83.44	85.63	86.57	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	220.19	195.01	207.09	190.2	191.78	173.88	167.15	183.2	182.81	196.62	202.4	214.66

Total = Sum(219a)$_{1...12}$ = 2324.98 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1732.91	
Water heating fuel used		2324.98	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		343.11	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	374.31	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	502.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =				876.5	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	178.07	(268)
Total CO2, kg/year			sum of (265)…(271) =		1093.5	(272)

TER = 15.39 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-8-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.5	(1a) x	2.4	(2a) =	178.8	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.5	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		178.8	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 5			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Walls Type1	39.17	17.25	21.92	x	0.18	=	3.95			(29)
Walls Type2	5.47	2.1	3.37	x	0.18	=	0.61			(29)
Roof	74.5	0	74.5	x	0.11	=	8.19			(30)
Total area of elements, m²			119.14							(31)
Party wall			51.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.02 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.71 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 50.73 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	80.23	80.23	80.23	80.23	80.23	80.23	80.23	80.23	80.23	80.23	80.23	80.23	

Average = $Sum(39)_{1...12}$ /12= 80.23 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	

Average = $Sum(40)_{1...12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.02 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	99.02	95.42	91.82	88.22	84.62	81.02	81.02	84.62	88.22	91.82	95.42	99.02	

Total = $Sum(44)_{1...12}$ = 1080.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.84	128.43	132.53	115.54	110.87	95.67	88.65	101.73	102.94	119.97	130.96	142.21	

Total = $Sum(45)_{1...12}$ = 1416.34 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.03	19.26	19.88	17.33	16.63	14.35	13.3	15.26	15.44	18	19.64	21.33	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.12	178.36	187.81	169.04	166.14	149.16	143.93	157	156.44	175.25	184.45	197.49	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.12	178.36	187.81	169.04	166.14	149.16	143.93	157	156.44	175.25	184.45	197.49

Output from water heater (annual)$_{1...12}$ | 2067.18 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.05	82.65	88.29	81.21	81.08	74.6	73.7	78.05	77.02	84.11	86.34	91.51	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.5	16.44	13.37	10.12	7.56	6.39	6.9	8.97	12.04	15.29	17.84	19.02	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	207.56	209.72	204.29	192.74	178.15	164.44	155.28	153.13	158.56	170.11	184.7	198.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	(71)

Water heating gains (Table 5)

(72)m=	125.06	122.98	118.67	112.8	108.98	103.62	99.06	104.9	106.98	113.05	119.91	122.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	409.39	407.39	394.58	373.9	352.95	332.7	319.49	325.25	335.83	356.7	380.71	398.67	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)

West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	73.82	143.33	238.41	359.1	455.14	473.73	447.72	373.65	280.31	170.24	91.72	60.97	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	483.2	550.72	632.99	733.01	808.09	806.42	767.21	698.9	616.14	526.94	472.43	459.64	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.81	0.61	0.46	0.52	0.79	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.9	20.05	20.31	20.63	20.88	20.98	21	20.99	20.92	20.58	20.18	19.86	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.91	0.75	0.53	0.36	0.41	0.72	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.56	18.77	19.15	19.6	19.91	20.01	20.02	20.02	19.96	19.54	18.96	18.5	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.1	19.28	19.61	20.01	20.3	20.39	20.41	20.41	20.34	19.96	19.44	19.05	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.1	19.28	19.61	20.01	20.3	20.39	20.41	20.41	20.34	19.96	19.44	19.05	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.77	0.56	0.4	0.46	0.74	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	480.75	544.95	615.17	667.86	620.53	453.88	304.23	318.63	457.84	499.99	467.49	457.82	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1187.24	1153.93	1051.83	891.67	689.64	464.85	305.63	321.48	500.68	750.89	990.37	1191.19	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	525.63	409.24	324.88	161.14	51.42	0	0	0	0	186.67	376.47	545.63	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ =	2581.07	(98)
Space heating requirement in kWh/m²/year	34.65	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2581.07	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2710.13	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2067.18	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2170.54	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	48.81	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		48.21	(330a)

warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =		48.21	(331)
Energy for lighting (calculated in Appendix L)			326.8	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1133.57	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	25.33	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1158.9	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1158.9	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	25.02	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	169.61	(379)
Total CO2, kg/year	sum of (376)…(382) =				1353.53	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				18.17	(384)
EI rating (section 14)					84.82	(385)

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User Details:

Assessor Name: | **Stroma Number:**

Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-8-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.5	(1a) x	2.4	(2a) =	178.8	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	178.8	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.76	x1/[1/(1.4)+ 0.04]		=	2.33			(27)
Windows Type 2			2.64	x1/[1/(1.4)+ 0.04]		=	3.5			(27)
Windows Type 3			2.64	x1/[1/(1.4)+ 0.04]		=	3.5			(27)
Windows Type 4			5.07	x1/[1/(1.4)+ 0.04]		=	6.72			(27)
Windows Type 5			4.41	x1/[1/(1.4)+ 0.04]		=	5.85			(27)
Walls Type1	39.17	16.52	22.65	x	0.18	=	4.08			(29)
Walls Type2	5.47	2.1	3.37	x	0.18	=	0.61			(29)
Roof	74.5	0	74.5	x	0.13	=	9.68			(30)
Total area of elements, m²			119.14							(31)
Party wall			51.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.37 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.23 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 45.6 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.55	35.32	35.09	34	33.8	32.86	32.86	32.69	33.22	33.8	34.21	34.64	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	81.15	80.91	80.68	79.6	79.4	78.46	78.46	78.28	78.82	79.4	79.81	80.23	

Average = Sum(39)$_{1...12}$ /12= 79.6 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.09	1.09	1.08	1.07	1.07	1.05	1.05	1.05	1.06	1.07	1.07	1.08	

Average = Sum(40)$_{1...12}$ /12= 1.07 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.02 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	99.02	95.42	91.82	88.22	84.62	81.02	81.02	84.62	88.22	91.82	95.42	99.02	

Total = Sum(44)$_{1...12}$ = 1080.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.84	128.43	132.53	115.54	110.87	95.67	88.65	101.73	102.94	119.97	130.96	142.21	

Total = Sum(45)$_{1...12}$ = 1416.34 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.03	19.26	19.88	17.33	16.63	14.35	13.3	15.26	15.44	18	19.64	21.33	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	193.44	170.52	179.12	160.63	157.46	140.76	135.25	148.32	148.03	166.56	176.05	188.81	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	193.44	170.52	179.12	160.63	157.46	140.76	135.25	148.32	148.03	166.56	176.05	188.81

Output from water heater (annual)$_{1\ldots12}$ — 1964.96 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.1	76.37	81.34	74.49	74.14	67.88	66.75	71.1	70.3	77.17	79.62	84.56	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.51	16.44	13.37	10.12	7.57	6.39	6.9	8.97	12.04	15.29	17.84	19.02	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	207.56	209.72	204.29	192.74	178.15	164.44	155.28	153.13	158.56	170.11	184.7	198.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	(71)

Water heating gains (Table 5)

(72)m=	115.73	113.65	109.33	103.46	99.65	94.28	89.72	95.57	97.64	103.72	110.58	113.66	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	403.05	401.06	388.24	367.57	346.62	326.36	313.16	318.92	329.49	350.37	374.37	392.34	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	2.64	x	10.63	x	0.63	x	0.7	=	8.58	(74)
North	0.9x	0.77	x	5.07	x	10.63	x	0.63	x	0.7	=	16.48	(74)
North	0.9x	0.77	x	2.64	x	20.32	x	0.63	x	0.7	=	16.4	(74)
North	0.9x	0.77	x	5.07	x	20.32	x	0.63	x	0.7	=	31.49	(74)
North	0.9x	0.77	x	2.64	x	34.53	x	0.63	x	0.7	=	27.86	(74)
North	0.9x	0.77	x	5.07	x	34.53	x	0.63	x	0.7	=	53.5	(74)
North	0.9x	0.77	x	2.64	x	55.46	x	0.63	x	0.7	=	44.75	(74)
North	0.9x	0.77	x	5.07	x	55.46	x	0.63	x	0.7	=	85.94	(74)
North	0.9x	0.77	x	2.64	x	74.72	x	0.63	x	0.7	=	60.28	(74)
North	0.9x	0.77	x	5.07	x	74.72	x	0.63	x	0.7	=	115.77	(74)
North	0.9x	0.77	x	2.64	x	79.99	x	0.63	x	0.7	=	64.53	(74)
North	0.9x	0.77	x	5.07	x	79.99	x	0.63	x	0.7	=	123.93	(74)
North	0.9x	0.77	x	2.64	x	74.68	x	0.63	x	0.7	=	60.25	(74)
North	0.9x	0.77	x	5.07	x	74.68	x	0.63	x	0.7	=	115.71	(74)
North	0.9x	0.77	x	2.64	x	59.25	x	0.63	x	0.7	=	47.8	(74)
North	0.9x	0.77	x	5.07	x	59.25	x	0.63	x	0.7	=	91.8	(74)
North	0.9x	0.77	x	2.64	x	41.52	x	0.63	x	0.7	=	33.5	(74)
North	0.9x	0.77	x	5.07	x	41.52	x	0.63	x	0.7	=	64.33	(74)
North	0.9x	0.77	x	2.64	x	24.19	x	0.63	x	0.7	=	19.52	(74)
North	0.9x	0.77	x	5.07	x	24.19	x	0.63	x	0.7	=	37.48	(74)
North	0.9x	0.77	x	2.64	x	13.12	x	0.63	x	0.7	=	10.58	(74)
North	0.9x	0.77	x	5.07	x	13.12	x	0.63	x	0.7	=	20.33	(74)
North	0.9x	0.77	x	2.64	x	8.86	x	0.63	x	0.7	=	7.15	(74)
North	0.9x	0.77	x	5.07	x	8.86	x	0.63	x	0.7	=	13.74	(74)
West	0.9x	0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(80)
West	0.9x	0.77	x	2.64	x	19.64	x	0.63	x	0.7	=	15.85	(80)
West	0.9x	0.77	x	4.41	x	19.64	x	0.63	x	0.7	=	26.47	(80)
West	0.9x	0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(80)
West	0.9x	0.77	x	2.64	x	38.42	x	0.63	x	0.7	=	31	(80)
West	0.9x	0.77	x	4.41	x	38.42	x	0.63	x	0.7	=	51.78	(80)
West	0.9x	0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(80)
West	0.9x	0.77	x	2.64	x	63.27	x	0.63	x	0.7	=	51.05	(80)
West	0.9x	0.77	x	4.41	x	63.27	x	0.63	x	0.7	=	85.28	(80)
West	0.9x	0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(80)
West	0.9x	0.77	x	2.64	x	92.28	x	0.63	x	0.7	=	74.45	(80)
West	0.9x	0.77	x	4.41	x	92.28	x	0.63	x	0.7	=	124.37	(80)
West	0.9x	0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(80)
West	0.9x	0.77	x	2.64	x	113.09	x	0.63	x	0.7	=	91.25	(80)
West	0.9x	0.77	x	4.41	x	113.09	x	0.63	x	0.7	=	152.42	(80)
West	0.9x	0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(80)
West	0.9x	0.77	x	2.64	x	115.77	x	0.63	x	0.7	=	93.41	(80)

West	0.9x	0.77	x	4.41	x	115.77	x	0.63	x	0.7	=	156.03	(80)
West	0.9x	0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(80)
West	0.9x	0.77	x	2.64	x	110.22	x	0.63	x	0.7	=	88.93	(80)
West	0.9x	0.77	x	4.41	x	110.22	x	0.63	x	0.7	=	148.55	(80)
West	0.9x	0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(80)
West	0.9x	0.77	x	2.64	x	94.68	x	0.63	x	0.7	=	76.39	(80)
West	0.9x	0.77	x	4.41	x	94.68	x	0.63	x	0.7	=	127.6	(80)
West	0.9x	0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(80)
West	0.9x	0.77	x	2.64	x	73.59	x	0.63	x	0.7	=	59.37	(80)
West	0.9x	0.77	x	4.41	x	73.59	x	0.63	x	0.7	=	99.18	(80)
West	0.9x	0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(80)
West	0.9x	0.77	x	2.64	x	45.59	x	0.63	x	0.7	=	36.78	(80)
West	0.9x	0.77	x	4.41	x	45.59	x	0.63	x	0.7	=	61.44	(80)
West	0.9x	0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(80)
West	0.9x	0.77	x	2.64	x	24.49	x	0.63	x	0.7	=	19.76	(80)
West	0.9x	0.77	x	4.41	x	24.49	x	0.63	x	0.7	=	33.01	(80)
West	0.9x	0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(80)
West	0.9x	0.77	x	2.64	x	16.15	x	0.63	x	0.7	=	13.03	(80)
West	0.9x	0.77	x	4.41	x	16.15	x	0.63	x	0.7	=	21.77	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	77.94	151.33	251.72	379.15	480.55	500.17	472.72	394.51	295.96	179.74	96.84	64.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	480.99	552.38	639.96	746.72	827.16	826.54	785.87	713.43	625.45	530.11	471.22	456.71	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.79	0.59	0.44	0.5	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.88	20.04	20.31	20.65	20.89	20.98	21	20.99	20.93	20.6	20.18	19.86	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.01	20.01	20.01	20.03	20.03	20.04	20.04	20.04	20.04	20.03	20.02	20.02	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.74	0.51	0.34	0.4	0.7	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.52	18.75	19.14	19.63	19.93	20.03	20.04	20.04	19.98	19.57	18.97	18.5	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.07	19.27	19.61	20.04	20.31	20.41	20.42	20.42	20.36	19.98	19.45	19.04	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.07	19.27	19.61	20.04	20.31	20.41	20.42	20.42	20.36	19.98	19.45	19.04	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.9	0.75	0.54	0.38	0.44	0.73	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	478.59	546.55	621.31	675.65	622.79	447.39	298.82	312.66	456.01	502.02	466.33	454.95	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1198.38	1162.39	1057.6	886.83	683.99	455.81	299.84	314.78	493.33	744.71	985.82	1190.85	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	535.52	413.84	324.6	152.05	45.54	0	0	0	0	180.56	374.03	547.51	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2573.65 (98)

Space heating requirement in kWh/m²/year 34.55 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	535.52	413.84	324.6	152.05	45.54	0	0	0	0	180.56	374.03	547.51		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	572.75	442.61	347.17	162.62	48.7	0	0	0	0	193.11	400.04	585.57		
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													2752.57	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	193.44	170.52	179.12	160.63	157.46	140.76	135.25	148.32	148.03	166.56	176.05	188.81		
Efficiency of water heater													79.8	(216)
(217)m=	87.39	87.09	86.38	84.67	81.97	79.8	79.8	79.8	79.8	85.03	86.78	87.49		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	221.35	195.79	207.36	189.72	192.09	176.39	169.48	185.87	185.51	195.89	202.88	215.8		
Total = Sum(219a)$_{1...12}$ =													2338.12	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2752.57

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Water heating fuel used			2338.12	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			326.83	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	594.55	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	505.03	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1099.59	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	169.63	(268)
Total CO2, kg/year		sum of (265)…(271) =		1308.14	(272)

TER = 17.56 (273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-9-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.68	(1a) x	2.4	(2a) =	128.83	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.68	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		128.83	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	35.36	12.88	22.48	x	0.18	=	4.05			(29)
Walls Type2	35.36	2.1	33.26	x	0.18	=	5.99			(29)
Roof	17.33	0	17.33	x	0.11	=	1.91			(30)
Total area of elements, m²			88.05							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 29.21 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.98 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 42.19 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	21.26	21.26	21.26	21.26	21.26	21.26	21.26	21.26	21.26	21.26	21.26	21.26	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	63.45	63.45	63.45	63.45	63.45	63.45	63.45	63.45	63.45	63.45	63.45	63.45

Average = Sum(39)$_{1…12}$ /12= 63.45 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18

Average = $Sum(40)_{1...12}$ /12= 1.18 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 1.8 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 76.92 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	84.61	81.53	78.45	75.38	72.3	69.22	69.22	72.3	75.38	78.45	81.53	84.61	
										Total = $Sum(44)_{1...12}$ =		923	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	125.47	109.74	113.24	98.73	94.73	81.74	75.75	86.92	87.96	102.51	111.9	121.51	
										Total = $Sum(45)_{1...12}$ =		1210.2	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.82	16.46	16.99	14.81	14.21	12.26	11.36	13.04	13.19	15.38	16.78	18.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = — 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1.03 (52)

Temperature factor from Table 2b — 0.6 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = — 1.03 (54)

Enter (50) or (54) in (55) — 1.03 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	180.75	159.67	168.52	152.22	150.01	135.24	131.02	142.2	141.45	157.79	165.39	176.79	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	180.75	159.67	168.52	152.22	150.01	135.24	131.02	142.2	141.45	157.79	165.39	176.79	

Output from water heater (annual)$_{1...12}$ 1861.04 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.94	76.43	81.87	75.62	75.72	69.97	69.41	73.12	72.04	78.31	80	84.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.98	12.41	10.1	7.64	5.71	4.82	5.21	6.77	9.09	11.55	13.48	14.37	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	156.78	158.4	154.3	145.58	134.56	124.21	117.29	115.66	119.76	128.49	139.51	149.86	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	(71)

Water heating gains (Table 5)

(72)m=	115.51	113.73	110.05	105.03	101.77	97.19	93.29	98.28	100.06	105.25	111.11	113.74	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	336.24	334.53	324.42	308.23	292.03	276.2	265.77	270.7	278.89	295.26	314.07	327.95	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)

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North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)

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East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	56.34	109.48	181.93	273.14	345.06	358.58	339.13	283.81	213.66	130.02	70.03	46.52	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	392.59	444.01	506.35	581.37	637.08	634.78	604.9	554.51	492.55	425.29	384.11	374.46	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.8	0.61	0.46	0.52	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.84	19.99	20.26	20.6	20.86	20.97	20.99	20.99	20.91	20.56	20.13	19.79	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.9	0.74	0.52	0.35	0.4	0.7	0.94	0.99	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.4	18.62	19.01	19.48	19.8	19.92	19.93	19.93	19.86	19.44	18.83	18.34	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.12	19.3	19.63	20.04	20.33	20.44	20.46	20.46	20.38	20	19.48	19.07	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.12	19.3	19.63	20.04	20.33	20.44	20.46	20.46	20.38	20	19.48	19.07	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.96	0.9	0.76	0.57	0.4	0.46	0.73	0.94	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	389.45	437.36	488.25	523.74	485.82	359.27	243.39	254.38	361.08	398.52	378.19	372.05	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	940.2	913.92	833.35	706.77	547.58	370.69	245.11	257.59	398.74	596.35	785.25	943.29	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	409.76	320.25	256.75	131.78	45.95	0	0	0	0	147.18	293.08	425	

Total per year (kWh/year) = $Sum(98)_{1…5,9…12}$ = 2029.75 (98)

Space heating requirement in kWh/m²/year 37.81 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2029.75	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2131.24	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1861.04	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1954.09	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	40.85	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		34.74	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	34.74	(331)
Energy for lighting (calculated in Appendix L)		246.84	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	948.85	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	21.2	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	970.05	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				970.05	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	18.03	(378)

CO2 associated with electricity for lighting	(332))) x	0.52	=	128.11	(379)
Total CO2, kg/year	sum of (376)…(382) =			1116.19	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			20.79	(384)
EI rating (section 14)				84.84	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-9-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.68	(1a) x	2.4	(2a) =	128.83	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.68	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	128.83	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.43	x1/[1/(1.4)+ 0.04]		=	3.22			(27)
Windows Type 2			4.04	x1/[1/(1.4)+ 0.04]		=	5.36			(27)
Windows Type 3			2.43	x1/[1/(1.4)+ 0.04]		=	3.22			(27)
Windows Type 4			2.43	x1/[1/(1.4)+ 0.04]		=	3.22			(27)
Walls Type1	35.36	11.33	24.03	x	0.18	=	4.33			(29)
Walls Type2	35.36	2.1	33.26	x	0.18	=	5.99			(29)
Roof	17.33	0	17.33	x	0.13	=	2.25			(30)
Total area of elements, m²			88.05							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 29.69 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.63 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 38.32 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.36	25.2	25.04	24.31	24.17	23.53	23.53	23.42	23.78	24.17	24.45	24.74	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	63.67	63.52	63.36	62.63	62.49	61.85	61.85	61.73	62.1	62.49	62.77	63.06	

Average = Sum(39)$_{1…12}$ /12= 62.63 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.19	1.18	1.18	1.17	1.16	1.15	1.15	1.15	1.16	1.16	1.17	1.17

Average = Sum(40)$_{1…12}$ /12= 1.17 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.8 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 76.92 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	84.61	81.53	78.45	75.38	72.3	69.22	69.22	72.3	75.38	78.45	81.53	84.61	
										Total = Sum(44)$_{1…12}$ =		923	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	125.47	109.74	113.24	98.73	94.73	81.74	75.75	86.92	87.96	102.51	111.9	121.51	
										Total = Sum(45)$_{1…12}$ =		1210.2	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.82	16.46	16.99	14.81	14.21	12.26	11.36	13.04	13.19	15.38	16.78	18.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	172.07	151.82	159.83	143.82	141.32	126.84	122.34	133.52	133.05	149.1	156.99	168.11	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	172.07	151.82	159.83	143.82	141.32	126.84	122.34	133.52	133.05	149.1	156.99	168.11

Output from water heater (annual)$_{1...12}$ 1758.81 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	79	70.16	74.93	68.9	68.77	63.25	62.46	66.18	65.32	71.36	73.28	77.68	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.01	12.44	10.12	7.66	5.73	4.84	5.22	6.79	9.11	11.57	13.51	14.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	156.78	158.4	154.3	145.58	134.56	124.21	117.29	115.66	119.76	128.49	139.51	149.86	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	(71)

Water heating gains (Table 5)

(72)m=	106.18	104.4	100.71	95.69	92.44	87.85	83.95	88.95	90.72	95.91	101.78	104.41	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	329.94	328.23	318.11	301.91	285.7	269.87	259.45	264.38	272.58	288.95	307.77	321.65	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.43	x	10.63	x	0.63	x	0.7	=	7.9	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.63	x	0.7	=	7.9	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.63	x	0.7	=	15.09	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.63	x	0.7	=	15.09	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.63	x	0.7	=	25.64	(74)

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North	0.9x	0.77	x	2.43	x	34.53	x	0.63	x	0.7	=	25.64	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.63	x	0.7	=	41.19	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.63	x	0.7	=	41.19	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.63	x	0.7	=	55.49	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.63	x	0.7	=	55.49	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.63	x	0.7	=	59.4	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.63	x	0.7	=	59.4	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.63	x	0.7	=	55.46	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.63	x	0.7	=	55.46	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.63	x	0.7	=	44	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.63	x	0.7	=	44	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.63	x	0.7	=	30.83	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.63	x	0.7	=	30.83	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.63	x	0.7	=	17.96	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.63	x	0.7	=	17.96	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.63	x	0.7	=	9.74	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.63	x	0.7	=	9.74	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.63	x	0.7	=	6.58	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.63	x	0.7	=	6.58	(74)
East	0.9x	1	x	2.43	x	19.64	x	0.63	x	0.7	=	14.59	(76)
East	0.9x	1	x	4.04	x	19.64	x	0.63	x	0.7	=	24.25	(76)
East	0.9x	1	x	2.43	x	38.42	x	0.63	x	0.7	=	28.53	(76)
East	0.9x	1	x	4.04	x	38.42	x	0.63	x	0.7	=	47.44	(76)
East	0.9x	1	x	2.43	x	63.27	x	0.63	x	0.7	=	46.99	(76)
East	0.9x	1	x	4.04	x	63.27	x	0.63	x	0.7	=	78.12	(76)
East	0.9x	1	x	2.43	x	92.28	x	0.63	x	0.7	=	68.53	(76)
East	0.9x	1	x	4.04	x	92.28	x	0.63	x	0.7	=	113.94	(76)
East	0.9x	1	x	2.43	x	113.09	x	0.63	x	0.7	=	83.99	(76)
East	0.9x	1	x	4.04	x	113.09	x	0.63	x	0.7	=	139.63	(76)
East	0.9x	1	x	2.43	x	115.77	x	0.63	x	0.7	=	85.98	(76)
East	0.9x	1	x	4.04	x	115.77	x	0.63	x	0.7	=	142.94	(76)
East	0.9x	1	x	2.43	x	110.22	x	0.63	x	0.7	=	81.85	(76)
East	0.9x	1	x	4.04	x	110.22	x	0.63	x	0.7	=	136.08	(76)
East	0.9x	1	x	2.43	x	94.68	x	0.63	x	0.7	=	70.31	(76)
East	0.9x	1	x	4.04	x	94.68	x	0.63	x	0.7	=	116.89	(76)
East	0.9x	1	x	2.43	x	73.59	x	0.63	x	0.7	=	54.65	(76)
East	0.9x	1	x	4.04	x	73.59	x	0.63	x	0.7	=	90.86	(76)
East	0.9x	1	x	2.43	x	45.59	x	0.63	x	0.7	=	33.86	(76)
East	0.9x	1	x	4.04	x	45.59	x	0.63	x	0.7	=	56.29	(76)
East	0.9x	1	x	2.43	x	24.49	x	0.63	x	0.7	=	18.19	(76)
East	0.9x	1	x	4.04	x	24.49	x	0.63	x	0.7	=	30.24	(76)

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East	0.9x	1	x	2.43	x	16.15	x	0.63	x	0.7	=	11.99	(76)
East	0.9x	1	x	4.04	x	16.15	x	0.63	x	0.7	=	19.94	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	54.63	106.15	176.4	264.85	334.59	347.72	328.85	275.2	207.17	126.07	67.91	45.1	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	384.57	434.38	494.51	566.76	620.3	617.59	588.3	539.58	479.75	415.03	375.67	366.75	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.8	0.61	0.46	0.52	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.82	19.97	20.24	20.6	20.86	20.97	20.99	20.99	20.91	20.56	20.13	19.79	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.93	19.94	19.95	19.95	19.96	19.96	19.96	19.95	19.95	19.94	19.94	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.9	0.75	0.53	0.35	0.4	0.7	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.37	18.6	18.99	19.49	19.82	19.94	19.96	19.96	19.89	19.45	18.83	18.34	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.09	19.28	19.62	20.04	20.34	20.46	20.48	20.47	20.4	20.01	19.48	19.07	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.09	19.28	19.62	20.04	20.34	20.46	20.48	20.47	20.4	20.01	19.48	19.07	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.77	0.57	0.4	0.46	0.74	0.94	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	381.74	428.4	478.2	513.49	477.59	351.47	238.13	248.54	354.22	390.36	370.33	364.58	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	942	913.53	830.99	697.75	539.69	362.2	239.71	251.47	390.99	587.77	777.1	937.37	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	416.83	326.01	262.48	132.67	46.2	0	0	0	0	146.87	292.88	426.16	(98)

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 2050.09 (98)

Space heating requirement in kWh/m²/year 38.19 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	416.83	326.01	262.48	132.67	46.2	0	0	0	0	146.87	292.88	426.16		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	445.81	348.67	280.73	141.89	49.42	0	0	0	0	157.08	313.24	455.78		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2192.61	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	172.07	151.82	159.83	143.82	141.32	126.84	122.34	133.52	133.05	149.1	156.99	168.11		
Efficiency of water heater													79.8	(216)
(217)m=	87.09	86.8	86.13	84.6	82.19	79.8	79.8	79.8	79.8	84.77	86.45	87.19		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	197.58	174.91	185.58	170	171.94	158.94	153.31	167.31	166.73	175.88	181.58	192.8		
Total = Sum(219a)$_{1...12}$ =													2096.57	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2192.61	
Water heating fuel used			2096.57	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			247.43	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	473.6	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	452.86	(264)
Space and water heating	(261) + (262) + (263) + (264) =				926.46	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	128.41	(268)

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Total CO2, kg/year	sum of (265)…(271) =	1093.8	(272)
TER =		20.38	(273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-9-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.65	(1a) x	2.4	(2a) =	121.56	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.65	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.56	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	36.62	11.96	24.66	x	0.18	=	4.44			(29)
Walls Type2	25.07	2.1	22.97	x	0.18	=	4.13			(29)
Roof	21.11	0	21.11	x	0.11	=	2.32			(30)
Total area of elements, m²			82.8							(31)
Party wall			14.75	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	27.11	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		13.3	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	40.41	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	60.46	60.46	60.46	60.46	60.46	60.46	60.46	60.46	60.46	60.46	60.46	60.46	

Average = Sum(39)$_{1…12}$ /12= 60.46 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	

Average = Sum(40)$_{1…12}$ /12= 1.19 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.79 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	82.27	79.28	76.29	73.3	70.31	67.32	67.32	70.31	73.3	76.29	79.28	82.27

Total = Sum(44)$_{1…12}$ = 897.54 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.01	106.71	110.12	96	92.12	79.49	73.66	84.52	85.53	99.68	108.81	118.16

Total = Sum(45)$_{1…12}$ = 1176.81 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.3	16.01	16.52	14.4	13.82	11.92	11.05	12.68	12.83	14.95	16.32	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	177.29	156.64	165.39	149.5	147.39	132.98	128.94	139.8	139.03	154.96	162.3	173.44	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	177.29	156.64	165.39	149.5	147.39	132.98	128.94	139.8	139.03	154.96	162.3	173.44

Output from water heater (annual)$_{1...12}$	1827.65	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.79	75.42	80.84	74.72	74.85	69.23	68.71	72.33	71.23	77.37	78.97	83.51	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.28	11.79	9.59	7.26	5.43	4.58	4.95	6.44	8.64	10.97	12.8	13.65	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.92	150.47	146.57	138.28	127.82	117.98	111.41	109.87	113.76	122.05	132.52	142.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	(71)

Water heating gains (Table 5)

(72)m=	113.96	112.24	108.65	103.77	100.6	96.15	92.36	97.21	98.94	103.99	109.69	112.24	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	324.8	323.14	313.45	297.95	282.49	267.35	257.36	262.15	269.97	285.64	303.64	316.88	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)

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East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)

South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	113.51	195.48	270.93	337.99	378.11	374.49	361.47	332.12	294.49	217.19	136.4	96.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	438.31	518.61	584.38	635.94	660.6	641.84	618.83	594.27	564.46	502.83	440.04	413.71	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.88	0.76	0.58	0.43	0.46	0.69	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.94	20.14	20.41	20.69	20.89	20.97	21	20.99	20.94	20.68	20.25	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.85	0.7	0.49	0.32	0.36	0.6	0.87	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.55	18.83	19.21	19.58	19.82	19.91	19.92	19.92	19.89	19.59	18.99	18.47	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.24	19.49	19.81	20.13	20.35	20.44	20.46	20.46	20.42	20.14	19.62	19.18	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.24	19.49	19.81	20.13	20.35	20.44	20.46	20.46	20.42	20.14	19.62	19.18	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.97	0.93	0.86	0.72	0.54	0.38	0.41	0.64	0.88	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	431.6	501.85	544.73	544.39	476.48	344.36	232.11	243.42	361.47	443.15	426.41	408.74	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	903.53	882.06	804.66	679.31	523.27	353.25	233.36	245.36	381.89	576.6	756.84	905.56	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	351.12	255.5	193.39	97.14	34.81	0	0	0	0	99.29	237.91	369.64	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1638.79 | (98)

Space heating requirement in kWh/m²/year | 32.36 | (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1638.79	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1720.73	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1827.65	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1919.03	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	36.4	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		32.78	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	32.78	(331)
Energy for lighting (calculated in Appendix L)		234.47	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	845.37	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	18.89	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	864.26	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				864.26	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	17.01	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	121.69	(379)
Total CO2, kg/year	sum of (376)…(382) =			1002.95	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			19.8	(384)
EI rating (section 14)				85.95	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-9-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.65	(1a) x	2.4	(2a) =	121.56	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.65	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.56	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.06	x1/[1/(1.4)+ 0.04]		=	5.38			(27)
Windows Type 2			2.44	x1/[1/(1.4)+ 0.04]		=	3.23			(27)
Windows Type 3			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 4			2.44	x1/[1/(1.4)+ 0.04]		=	3.23			(27)
Walls Type1	36.62	10.56	26.06	x	0.18	=	4.69			(29)
Walls Type2	25.07	2.1	22.97	x	0.18	=	4.13			(29)
Roof	21.11	0	21.11	x	0.13	=	2.74			(30)
Total area of elements, m²			82.8							(31)
Party wall			14.75	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	27.67	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		8.75	(36)
if details of thermal bridging are not known (36) = 0.15 x (31)			
Total fabric heat loss	(33) + (36) =	36.42	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	24.11	23.95	23.79	23.07	22.94	22.3	22.3	22.19	22.55	22.94	23.21	23.5	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	60.52	60.37	60.21	59.49	59.35	58.72	58.72	58.61	58.97	59.35	59.63	59.91	

Average = $Sum(39)_{1...12}$ /12= 59.49 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.19	1.19	1.19	1.17	1.17	1.16	1.16	1.16	1.16	1.17	1.18	1.18	

Average = $Sum(40)_{1...12}$ /12= 1.17 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.79 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	82.27	79.28	76.29	73.3	70.31	67.32	67.32	70.31	73.3	76.29	79.28	82.27	

Total = $Sum(44)_{1...12}$ = 897.54 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.01	106.71	110.12	96	92.12	79.49	73.66	84.52	85.53	99.68	108.81	118.16	

Total = $Sum(45)_{1...12}$ = 1176.81 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.3	16.01	16.52	14.4	13.82	11.92	11.05	12.68	12.83	14.95	16.32	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.61	148.8	156.71	141.09	138.71	124.58	120.25	131.12	130.63	146.28	153.9	164.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.61	148.8	156.71	141.09	138.71	124.58	120.25	131.12	130.63	146.28	153.9	164.76	

Output from water heater (annual)$_{1...12}$	1725.43	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.84	69.15	73.89	67.99	67.9	62.5	61.77	65.38	64.51	70.42	72.25	76.56	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.32	11.83	9.62	7.28	5.44	4.6	4.97	6.46	8.67	11	12.84	13.69	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.92	150.47	146.57	138.28	127.82	117.98	111.41	109.87	113.76	122.05	132.52	142.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	(71)

Water heating gains (Table 5)

(72)m=	104.63	102.9	99.31	94.44	91.27	86.81	83.02	87.88	89.6	94.65	100.35	102.91	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.51	316.84	307.15	291.64	276.17	261.03	251.04	255.84	263.67	279.34	297.35	310.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.44	x	19.64	x	0.63	x	0.7	=	14.65	(76)
East	0.9x	1	x	2.44	x	19.64	x	0.63	x	0.7	=	14.65	(76)

East	0.9x	1	x	2.44	x	38.42	x	0.63	x	0.7	=	28.65	(76)
East	0.9x	1	x	2.44	x	38.42	x	0.63	x	0.7	=	28.65	(76)
East	0.9x	1	x	2.44	x	63.27	x	0.63	x	0.7	=	47.18	(76)
East	0.9x	1	x	2.44	x	63.27	x	0.63	x	0.7	=	47.18	(76)
East	0.9x	1	x	2.44	x	92.28	x	0.63	x	0.7	=	68.81	(76)
East	0.9x	1	x	2.44	x	92.28	x	0.63	x	0.7	=	68.81	(76)
East	0.9x	1	x	2.44	x	113.09	x	0.63	x	0.7	=	84.33	(76)
East	0.9x	1	x	2.44	x	113.09	x	0.63	x	0.7	=	84.33	(76)
East	0.9x	1	x	2.44	x	115.77	x	0.63	x	0.7	=	86.33	(76)
East	0.9x	1	x	2.44	x	115.77	x	0.63	x	0.7	=	86.33	(76)
East	0.9x	1	x	2.44	x	110.22	x	0.63	x	0.7	=	82.19	(76)
East	0.9x	1	x	2.44	x	110.22	x	0.63	x	0.7	=	82.19	(76)
East	0.9x	1	x	2.44	x	94.68	x	0.63	x	0.7	=	70.6	(76)
East	0.9x	1	x	2.44	x	94.68	x	0.63	x	0.7	=	70.6	(76)
East	0.9x	1	x	2.44	x	73.59	x	0.63	x	0.7	=	54.88	(76)
East	0.9x	1	x	2.44	x	73.59	x	0.63	x	0.7	=	54.88	(76)
East	0.9x	1	x	2.44	x	45.59	x	0.63	x	0.7	=	34	(76)
East	0.9x	1	x	2.44	x	45.59	x	0.63	x	0.7	=	34	(76)
East	0.9x	1	x	2.44	x	24.49	x	0.63	x	0.7	=	18.26	(76)
East	0.9x	1	x	2.44	x	24.49	x	0.63	x	0.7	=	18.26	(76)
East	0.9x	1	x	2.44	x	16.15	x	0.63	x	0.7	=	12.04	(76)
East	0.9x	1	x	2.44	x	16.15	x	0.63	x	0.7	=	12.04	(76)
South	0.9x	0.77	x	4.06	x	46.75	x	0.63	x	0.7	=	58.01	(78)
South	0.9x	0.77	x	1.62	x	46.75	x	0.63	x	0.7	=	23.15	(78)
South	0.9x	0.77	x	4.06	x	76.57	x	0.63	x	0.7	=	95	(78)
South	0.9x	0.77	x	1.62	x	76.57	x	0.63	x	0.7	=	37.91	(78)
South	0.9x	0.77	x	4.06	x	97.53	x	0.63	x	0.7	=	121.02	(78)
South	0.9x	0.77	x	1.62	x	97.53	x	0.63	x	0.7	=	48.29	(78)
South	0.9x	0.77	x	4.06	x	110.23	x	0.63	x	0.7	=	136.78	(78)
South	0.9x	0.77	x	1.62	x	110.23	x	0.63	x	0.7	=	54.58	(78)
South	0.9x	0.77	x	4.06	x	114.87	x	0.63	x	0.7	=	142.53	(78)
South	0.9x	0.77	x	1.62	x	114.87	x	0.63	x	0.7	=	56.87	(78)
South	0.9x	0.77	x	4.06	x	110.55	x	0.63	x	0.7	=	137.17	(78)
South	0.9x	0.77	x	1.62	x	110.55	x	0.63	x	0.7	=	54.73	(78)
South	0.9x	0.77	x	4.06	x	108.01	x	0.63	x	0.7	=	134.02	(78)
South	0.9x	0.77	x	1.62	x	108.01	x	0.63	x	0.7	=	53.48	(78)
South	0.9x	0.77	x	4.06	x	104.89	x	0.63	x	0.7	=	130.15	(78)
South	0.9x	0.77	x	1.62	x	104.89	x	0.63	x	0.7	=	51.93	(78)
South	0.9x	0.77	x	4.06	x	101.89	x	0.63	x	0.7	=	126.42	(78)
South	0.9x	0.77	x	1.62	x	101.89	x	0.63	x	0.7	=	50.44	(78)
South	0.9x	0.77	x	4.06	x	82.59	x	0.63	x	0.7	=	102.47	(78)

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South	0.9x	0.77	x	1.62	x	82.59	x	0.63	x	0.7	=	40.89	(78)
South	0.9x	0.77	x	4.06	x	55.42	x	0.63	x	0.7	=	68.76	(78)
South	0.9x	0.77	x	1.62	x	55.42	x	0.63	x	0.7	=	27.44	(78)
South	0.9x	0.77	x	4.06	x	40.4	x	0.63	x	0.7	=	50.13	(78)
South	0.9x	0.77	x	1.62	x	40.4	x	0.63	x	0.7	=	20	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	110.45	190.21	263.67	328.98	368.07	364.56	351.87	323.28	286.61	211.35	132.72	94.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	428.96	507.05	570.82	620.62	644.24	625.59	602.91	579.12	550.28	490.69	430.07	404.8	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.89	0.76	0.58	0.42	0.46	0.69	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.92	20.13	20.39	20.69	20.89	20.98	21	20.99	20.95	20.69	20.25	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.92	19.93	19.93	19.94	19.94	19.95	19.95	19.95	19.95	19.94	19.94	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.94	0.85	0.7	0.49	0.33	0.36	0.6	0.88	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.52	18.81	19.19	19.6	19.84	19.94	19.95	19.95	19.91	19.61	19	18.47	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.22	19.47	19.79	20.14	20.36	20.46	20.47	20.47	20.43	20.15	19.63	19.18	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.22	19.47	19.79	20.14	20.36	20.46	20.47	20.47	20.43	20.15	19.63	19.18	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.86	0.73	0.54	0.38	0.41	0.64	0.89	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	422.9	491.88	534.58	534.49	468.22	335.97	226.39	237.05	353.97	434.64	417.61	400.32	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	903.09	879.49	800.46	668.84	514.27	344.01	227.48	238.73	373.27	566.69	746.86	897.46	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	357.26	260.47	197.82	96.73	34.26	0	0	0	0	98.24	237.06	369.87	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1651.72 | (98)

Space heating requirement in kWh/m²/year | 32.61 | (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	357.26	260.47	197.82	96.73	34.26	0	0	0	0	98.24	237.06	369.87		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	382.1	278.58	211.57	103.46	36.64	0	0	0	0	105.07	253.54	395.59		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													1766.54	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	168.61	148.8	156.71	141.09	138.71	124.58	120.25	131.12	130.63	146.28	153.9	164.76		
Efficiency of water heater													79.8	(216)
(217)m=	86.77	86.29	85.44	83.83	81.71	79.8	79.8	79.8	79.8	83.78	85.96	86.91		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	194.31	172.43	183.42	168.31	169.75	156.12	150.69	164.31	163.69	174.6	179.03	189.57		
Total = Sum(219a)$_{1...12}$ =													2066.24	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1766.54	
Water heating fuel used			2066.24	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			235.23	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	381.57	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	446.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =			827.88	(265)

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Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	122.09	(268)
Total CO2, kg/year			sum of (265)…(271) =		988.89	(272)

TER =	19.52	(273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-9-03

Address :	Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	101.62	(1a) x	2.4	(2a) =	243.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	101.62	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	243.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Walls Type1	49.24	18.86	30.38	x	0.18	=	5.47			(29)
Walls Type2	14.73	2.1	12.63	x	0.18	=	2.27			(29)
Roof	31.96	0	31.96	x	0.11	=	3.52			(30)
Total area of elements, m²			95.93							(31)
Party wall			34.51	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.37 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.94 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 51.31 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.24	40.24	40.24	40.24	40.24	40.24	40.24	40.24	40.24	40.24	40.24	40.24	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	91.55	91.55	91.55	91.55	91.55	91.55	91.55	91.55	91.55	91.55	91.55	91.55	

Average = Sum(39)$_{1\ldots12}$ /12= 91.55 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	

Average = Sum(40)$_{1\ldots12}$ /12= 0.9 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.75 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.61 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.57	105.58	101.6	97.62	93.63	89.65	89.65	93.63	97.62	101.6	105.58	109.57	

Total = Sum(44)$_{1\ldots12}$ = 1195.3 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	162.49	142.11	146.65	127.85	122.68	105.86	98.09	112.57	113.91	132.75	144.91	157.36	

Total = Sum(45)$_{1\ldots12}$ = 1567.22 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.37	21.32	22	19.18	18.4	15.88	14.71	16.88	17.09	19.91	21.74	23.6	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	217.76	192.04	201.92	181.34	177.95	159.35	153.37	167.84	167.4	188.03	198.4	212.64	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	217.76	192.04	201.92	181.34	177.95	159.35	153.37	167.84	167.4	188.03	198.4	212.64

Output from water heater (annual)$_{1...12}$ — 2218.06 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	98.25	87.19	92.98	85.31	85.01	77.99	76.84	81.65	80.67	88.36	90.98	96.54	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	23.13	20.54	16.71	12.65	9.46	7.98	8.63	11.21	15.05	19.11	22.3	23.77	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	258.92	261.61	254.84	240.42	222.23	205.13	193.7	191.02	197.79	212.2	230.4	247.5	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	(71)

Water heating gains (Table 5)

(72)m=	132.05	129.75	124.98	118.48	114.26	108.32	103.28	109.74	112.04	118.76	126.36	129.76	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	478.42	476.22	460.83	435.86	410.26	385.74	369.92	376.28	389.19	414.38	443.36	465.34	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	5.29	x	46.75	x	0.5	x	0.8	=	68.56	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	5.29	x	76.57	x	0.5	x	0.8	=	112.28	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	5.29	x	97.53	x	0.5	x	0.8	=	143.02	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	5.29	x	110.23	x	0.5	x	0.8	=	161.65	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	5.29	x	114.87	x	0.5	x	0.8	=	168.45	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	5.29	x	110.55	x	0.5	x	0.8	=	162.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	5.29	x	108.01	x	0.5	x	0.8	=	158.39	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	5.29	x	104.89	x	0.5	x	0.8	=	153.82	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	5.29	x	101.89	x	0.5	x	0.8	=	149.4	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	5.29	x	82.59	x	0.5	x	0.8	=	121.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	5.29	x	55.42	x	0.5	x	0.8	=	81.26	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	5.29	x	40.4	x	0.5	x	0.8	=	59.24	(78)
West	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(80)

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West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	183.92	315.17	433.45	536.24	596.58	589.6	569.61	525.59	469.52	349.2	220.71	157.09	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	662.34	791.39	894.29	972.1	1006.83	975.34	939.52	901.87	858.7	763.58	664.07	622.44	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.91	0.78	0.59	0.43	0.46	0.7	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.33	20.55	20.78	20.93	20.99	21	21	20.97	20.77	20.41	20.11	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.88	0.73	0.52	0.35	0.38	0.63	0.91	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.29	19.61	19.92	20.11	20.16	20.17	20.17	20.15	19.91	19.4	18.97	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.38	19.6	19.89	20.18	20.36	20.41	20.42	20.42	20.39	20.17	19.7	19.32	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.38	19.6	19.89	20.18	20.36	20.41	20.42	20.42	20.39	20.17	19.7	19.32	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.88	0.74	0.54	0.37	0.41	0.65	0.91	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	658.52	778.59	855.32	859.88	745.02	525.91	348.85	366.74	558.86	696.11	654.39	619.89	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1380.31	1346.13	1226.15	1032.77	792.38	531.83	349.36	367.62	576.25	876.06	1153.71	1383.82	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	537.01	381.39	275.9	124.48	35.23	0	0	0	0	133.88	359.51	568.36	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 2415.76 (98)

Space heating requirement in kWh/m²/year 23.77 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2415.76	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2536.55	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2218.06	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2328.97	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	48.66	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		65.76	(330a)

warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =		65.76	(331)
Energy for lighting (calculated in Appendix L)			408.5	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1130.06	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	25.25	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1155.31	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1155.31	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	34.13	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	212.01	(379)
Total CO2, kg/year	sum of (376)…(382) =				1401.45	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				13.79	(384)
EI rating (section 14)					87.19	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-9-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	101.62	(1a) x	2.4	(2a) =	243.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	101.62	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	243.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 5			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Walls Type1	49.24	18.86	30.38	x	0.18	=	5.47			(29)
Walls Type2	14.73	2.1	12.63	x	0.18	=	2.27			(29)
Roof	31.96	0	31.96	x	0.13	=	4.15			(30)
Total area of elements, m²			95.93							(31)
Party wall			34.51	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.03 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 49.03 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	48.34	48.03	47.72	46.27	46	44.74	44.74	44.51	45.23	46	46.55	47.12	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	97.37	97.06	96.75	95.3	95.03	93.77	93.77	93.53	94.25	95.03	95.58	96.15	

Average = Sum(39)$_{1…12}$ /12= 95.3 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.96	0.96	0.95	0.94	0.94	0.92	0.92	0.92	0.93	0.94	0.94	0.95	

Average = Sum(40)$_{1…12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.75 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.61 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	109.57	105.58	101.6	97.62	93.63	89.65	89.65	93.63	97.62	101.6	105.58	109.57	

Total = Sum(44)$_{1…12}$ = 1195.3 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	162.49	142.11	146.65	127.85	122.68	105.86	98.09	112.57	113.91	132.75	144.91	157.36	

Total = Sum(45)$_{1…12}$ = 1567.22 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.37	21.32	22	19.18	18.4	15.88	14.71	16.88	17.09	19.91	21.74	23.6	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	209.08	184.2	193.24	172.94	169.27	150.95	144.69	159.16	159	179.35	190	203.96	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	209.08	184.2	193.24	172.94	169.27	150.95	144.69	159.16	159	179.35	190	203.96

Output from water heater (annual)$_{1...12}$ | 2115.84 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.3	80.92	86.04	78.58	78.07	71.27	69.89	74.7	73.95	81.42	84.26	89.6	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	23.47	20.84	16.95	12.83	9.59	8.1	8.75	11.37	15.27	19.38	22.62	24.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	258.92	261.61	254.84	240.42	222.23	205.13	193.7	191.02	197.79	212.2	230.4	247.5	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	(71)

Water heating gains (Table 5)

(72)m=	122.72	120.42	115.64	109.14	104.93	98.99	93.94	100.41	102.71	109.43	117.02	120.43	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	472.42	470.18	454.74	429.71	404.06	379.52	363.71	370.11	383.07	408.32	437.35	459.35	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	5.29	x	46.75	x	0.63	x	0.7	=	75.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	5.29	x	76.57	x	0.63	x	0.7	=	123.79	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	5.29	x	97.53	x	0.63	x	0.7	=	157.68	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	5.29	x	110.23	x	0.63	x	0.7	=	178.22	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	5.29	x	114.87	x	0.63	x	0.7	=	185.71	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	5.29	x	110.55	x	0.63	x	0.7	=	178.72	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	5.29	x	108.01	x	0.63	x	0.7	=	174.62	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	5.29	x	104.89	x	0.63	x	0.7	=	169.58	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	5.29	x	101.89	x	0.63	x	0.7	=	164.72	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	5.29	x	82.59	x	0.63	x	0.7	=	133.52	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	5.29	x	55.42	x	0.63	x	0.7	=	89.59	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	5.29	x	40.4	x	0.63	x	0.7	=	65.31	(78)
West	0.9x	0.77	x	5.29	x	19.64	x	0.63	x	0.7	=	31.75	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.63	x	0.7	=	62.11	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.63	x	0.7	=	102.29	(80)

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West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.63	x	0.7	=	149.19	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.63	x	0.7	=	182.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.63	x	0.7	=	187.17	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.63	x	0.7	=	178.19	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.63	x	0.7	=	153.06	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.63	x	0.7	=	118.97	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.63	x	0.7	=	73.7	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.63	x	0.7	=	39.59	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.63	x	0.7	=	26.11	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	202.77	347.48	477.88	591.2	657.73	650.03	627.99	579.46	517.64	384.99	243.33	173.2	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	675.19	817.65	932.62	1020.91	1061.78	1029.56	991.7	949.57	900.71	793.32	680.68	632.55	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.77	0.57	0.41	0.45	0.69	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.28	20.52	20.78	20.93	20.99	21	21	20.97	20.76	20.37	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.12	20.12	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.13	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.88	0.71	0.5	0.34	0.37	0.62	0.91	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.9	19.18	19.53	19.89	20.08	20.14	20.15	20.15	20.12	19.87	19.33	18.86	(90)

fLA = Living area ÷ (4) = | 0.3 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.26	19.51	19.82	20.15	20.33	20.4	20.4	20.4	20.38	20.14	19.64	19.22	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.26	19.51	19.82	20.15	20.33	20.4	20.4	20.4	20.38	20.14	19.64	19.22	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.98	0.95	0.88	0.73	0.52	0.36	0.39	0.64	0.91	0.98	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	671.07	803.48	889.26	894.36	772.24	537.98	356.12	373.68	574.49	719.21	670.16	629.8		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	1456.33	1417.84	1289.14	1072.45	820.49	543.54	356.61	374.51	591.8	906.57	1198.48	1444.16		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	584.23	412.85	297.5	128.23	35.9	0	0	0	0	139.39	380.39	605.88		
Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =													2584.38	(98)
Space heating requirement in kWh/m²/year													25.43	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	584.23	412.85	297.5	128.23	35.9	0	0	0	0	139.39	380.39	605.88		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	624.85	441.55	318.19	137.14	38.39	0	0	0	0	149.08	406.84	648		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2764.04	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	209.08	184.2	193.24	172.94	169.27	150.95	144.69	159.16	159	179.35	190	203.96		
Efficiency of water heater													79.8	(216)
(217)m=	87.41	86.9	85.96	84.03	81.49	79.8	79.8	79.8	79.8	84.15	86.63	87.54		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	239.19	211.95	224.8	205.81	207.73	189.16	181.32	199.45	199.25	213.12	219.32	232.98		
Total = Sum(219a)$_{1...12}$ =													2524.09	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2764.04

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Water heating fuel used			2524.09	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			414.41	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	597.03	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	545.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1142.24	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	215.08	(268)
Total CO2, kg/year			sum of (265)…(271) =		1396.24	(272)
TER =					13.74	(273)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-9-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	104.77	(1a) x	2.4	(2a) =	251.45	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	104.77	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		251.45	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 5			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 6			9.06	x1/[1/(1.2)+ 0.04]		=	10.37			(27)
Windows Type 7			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	50.36	21.94	28.42	x	0.18	=	5.12			(29)
Walls Type2	31.52	2.1	29.42	x	0.18	=	5.3			(29)
Roof	28.91	0	28.91	x	0.11	=	3.18			(30)
Total area of elements, m²			110.79							(31)
Party wall			18.84	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 41.23 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 20.39 (36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 61.62 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.49	41.49	41.49	41.49	41.49	41.49	41.49	41.49	41.49	41.49	41.49	41.49	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	103.11	103.11	103.11	103.11	103.11	103.11	103.11	103.11	103.11	103.11	103.11	103.11	

Average = Sum(39)$_{1…12}$ /12= 103.11 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	

Average = Sum(40)$_{1…12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.78 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 100.21 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	110.23	106.23	102.22	98.21	94.2	90.19	90.19	94.2	98.21	102.22	106.23	110.23

Total = Sum(44)$_{1…12}$ = 1202.56 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	163.47	142.98	147.54	128.63	123.42	106.5	98.69	113.25	114.6	133.56	145.79	158.32

Total = Sum(45)$_{1…12}$ = 1576.75 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.52	21.45	22.13	19.29	18.51	15.98	14.8	16.99	17.19	20.03	21.87	23.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	218.75	192.9	202.82	182.12	178.7	160	153.97	168.53	168.1	188.83	199.28	213.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	218.75	192.9	202.82	182.12	178.7	160	153.97	168.53	168.1	188.83	199.28	213.59

Output from water heater (annual)$_{1...12}$ | 2227.59 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	98.58	87.48	93.28	85.56	85.26	78.21	77.04	81.88	80.9	88.63	91.27	96.86	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	23.52	20.89	16.99	12.86	9.61	8.12	8.77	11.4	15.3	19.43	22.68	24.17	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	263.82	266.55	259.66	244.97	226.43	209.01	197.37	194.63	201.53	216.21	234.75	252.18	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	(71)

Water heating gains (Table 5)

(72)m=	132.5	130.18	125.37	118.84	114.6	108.62	103.54	110.05	112.36	119.13	126.76	130.19	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	484.52	482.32	466.71	441.36	415.33	390.44	374.37	380.77	393.88	419.46	448.88	471.23	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	9.06	x	10.63	x	0.5	x	0.8	=	26.71	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	9.06	x	20.32	x	0.5	x	0.8	=	51.03	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	9.06	x	34.53	x	0.5	x	0.8	=	86.72	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	9.06	x	55.46	x	0.5	x	0.8	=	139.3	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	9.06	x	74.72	x	0.5	x	0.8	=	187.64	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	9.06	x	79.99	x	0.5	x	0.8	=	200.88	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	9.06	x	74.68	x	0.5	x	0.8	=	187.55	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	9.06	x	59.25	x	0.5	x	0.8	=	148.79	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	9.06	x	41.52	x	0.5	x	0.8	=	104.27	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	9.06	x	24.19	x	0.5	x	0.8	=	60.75	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	9.06	x	13.12	x	0.5	x	0.8	=	32.94	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	9.06	x	8.86	x	0.5	x	0.8	=	22.26	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)

West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)

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West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	89.94	174.36	290.64	440.6	562.06	586.84	553.87	459.71	342.47	207.15	111.68	74.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	574.46	656.68	757.35	881.96	977.39	977.28	928.24	840.48	736.35	626.61	560.56	545.59	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.84	0.65	0.48	0.55	0.84	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.94	20.07	20.31	20.63	20.87	20.98	21	20.99	20.91	20.58	20.19	19.9	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.94	0.79	0.57	0.39	0.45	0.77	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.67	18.86	19.21	19.66	19.98	20.08	20.1	20.09	20.02	19.59	19.04	18.62	(90)

fLA = Living area ÷ (4) = | 0.3 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.05	19.22	19.54	19.95	20.25	20.35	20.37	20.36	20.29	19.89	19.38	19	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.05	19.22	19.54	19.95	20.25	20.35	20.37	20.36	20.29	19.89	19.38	19	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.8	0.59	0.42	0.48	0.78	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	573.07	653.08	744.56	825.52	785.26	578.95	386.7	405.18	577.28	606.15	557.56	544.59	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1520.79	1476.92	1344.56	1138.97	881.15	592.93	388.27	408.64	638.33	957.77	1266.64	1526.18	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	705.1	553.62	446.4	225.68	71.35	0	0	0	0	261.6	510.53	730.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 3504.58 | (98)

Space heating requirement in kWh/m²/year | 33.45 | (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		3504.58	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	3679.81	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2227.59	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2338.97	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	60.19	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		67.8	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	67.8	(331)
Energy for lighting (calculated in Appendix L)		415.36	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1397.91	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	31.24	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1429.15	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1429.15	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	35.19	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	215.57	(379)
Total CO2, kg/year	sum of (376)…(382) =			1679.91	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.03	(384)
EI rating (section 14)				84.97	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-9-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	104.77	(1a) x	2.4	(2a) =	251.45	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	104.77	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		251.45	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.43	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 4			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 5			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 6			9.06	x1/[1/(1.4)+ 0.04]		=	12.01			(27)
Windows Type 7			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	50.36	21.94	28.42	x	0.18	=	5.12			(29)
Walls Type2	31.52	2.1	29.42	x	0.18	=	5.3			(29)
Roof	28.91	0	28.91	x	0.13	=	3.76			(30)
Total area of elements, m²			110.79							(31)
Party wall			18.84	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 45.36 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.64 (36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 57 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	49.64	49.33	49.02	47.56	47.29	46.02	46.02	45.78	46.51	47.29	47.84	48.41	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	106.64	106.33	106.02	104.56	104.29	103.02	103.02	102.78	103.5	104.29	104.84	105.41	

Average = Sum(39)$_{1...12}$ /12= 104.56 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.02	1.01	1.01	1	1	0.98	0.98	0.98	0.99	1	1	1.01	

Average = Sum(40)$_{1...12}$ /12= 1 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.78 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 100.21 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	110.23	106.23	102.22	98.21	94.2	90.19	90.19	94.2	98.21	102.22	106.23	110.23	

Total = Sum(44)$_{1...12}$ = 1202.56 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	163.47	142.98	147.54	128.63	123.42	106.5	98.69	113.25	114.6	133.56	145.79	158.32	

Total = Sum(45)$_{1...12}$ = 1576.75 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.52	21.45	22.13	19.29	18.51	15.98	14.8	16.99	17.19	20.03	21.87	23.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.07	185.06	194.13	173.72	170.02	151.6	145.29	159.84	159.69	180.15	190.88	204.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	210.07	185.06	194.13	173.72	170.02	151.6	145.29	159.84	159.69	180.15	190.88	204.91	

Output from water heater (annual)$_{1...12}$ — 2125.36 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.63	81.21	86.33	78.84	78.31	71.49	70.09	74.93	74.18	81.68	84.55	89.92	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	23.59	20.95	17.04	12.9	9.64	8.14	8.8	11.43	15.35	19.49	22.74	24.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	263.82	266.55	259.66	244.97	226.43	209.01	197.37	194.63	201.53	216.21	234.75	252.18	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	(71)

Water heating gains (Table 5)

(72)m=	123.16	120.85	116.04	109.5	105.26	99.29	94.21	100.71	103.03	109.79	117.43	120.86	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	478.26	476.04	460.43	435.06	409.03	384.13	368.06	374.47	387.59	413.18	442.62	464.97	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	9.06	x	10.63	x	0.63	x	0.7	=	29.44	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	9.06	x	20.32	x	0.63	x	0.7	=	56.27	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	9.06	x	34.53	x	0.63	x	0.7	=	95.61	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	9.06	x	55.46	x	0.63	x	0.7	=	153.57	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	9.06	x	74.72	x	0.63	x	0.7	=	206.88	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	9.06	x	79.99	x	0.63	x	0.7	=	221.47	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	9.06	x	74.68	x	0.63	x	0.7	=	206.77	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	9.06	x	59.25	x	0.63	x	0.7	=	164.04	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	9.06	x	41.52	x	0.63	x	0.7	=	114.95	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	9.06	x	24.19	x	0.63	x	0.7	=	66.98	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	9.06	x	13.12	x	0.63	x	0.7	=	36.32	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	9.06	x	8.86	x	0.63	x	0.7	=	24.54	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)

West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)

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West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	99.15	192.23	320.43	485.76	619.67	646.99	610.64	506.83	377.57	228.38	123.13	81.97	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	577.41	668.28	780.85	920.83	1028.7	1031.12	978.7	881.3	765.16	641.56	565.74	546.94	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.82	0.62	0.46	0.53	0.82	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.89	20.04	20.3	20.64	20.89	20.98	21	20.99	20.92	20.58	20.18	19.87	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.07	20.07	20.07	20.09	20.09	20.1	20.1	20.1	20.09	20.09	20.08	20.08	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.98	0.93	0.77	0.54	0.37	0.43	0.75	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.58	18.8	19.17	19.66	19.98	20.09	20.1	20.1	20.03	19.59	19.01	18.56	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.98	19.17	19.51	19.96	20.25	20.35	20.37	20.37	20.3	19.89	19.36	18.95	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.98	19.17	19.51	19.96	20.25	20.35	20.37	20.37	20.3	19.89	19.36	18.95	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.78	0.56	0.4	0.46	0.77	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	575.97	664.35	766.3	854.14	805.48	581.86	386.82	404.95	586.46	618.97	562.59	545.92	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1565.02	1517.11	1379.11	1155.96	891.85	592.82	388.01	407.63	641.37	968.41	1285.03	1555.12	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	735.86	573.06	455.93	217.31	64.27	0	0	0	0	259.99	520.16	750.84	

Total per year (kWh/year) = Sum(98)1...5,9...12 = 3577.4 (98)

Space heating requirement in kWh/m²/year 34.15 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	735.86	573.06	455.93	217.31	64.27	0	0	0	0	259.99	520.16	750.84		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	787.01	612.89	487.63	232.42	68.73	0	0	0	0	278.06	556.32	803.04		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3826.1	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	210.07	185.06	194.13	173.72	170.02	151.6	145.29	159.84	159.69	180.15	190.88	204.91		
Efficiency of water heater													79.8	(216)
(217)m=	87.88	87.63	87.02	85.41	82.47	79.8	79.8	79.8	79.8	85.79	87.36	87.97		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	239.03	211.18	223.1	203.39	206.14	189.97	182.06	200.31	200.12	209.99	218.51	232.93		
Total = Sum(219a)$_{1...12}$ =													2516.73	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3826.1	
Water heating fuel used			2516.73	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			416.58	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	826.44	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.61	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1370.05	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	216.21	(268)
Total CO2, kg/year		sum of (265)…(271) =		1625.18	(272)

TER = 15.51 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version: Version: 1.0.4.8

Property Address: b2-10-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.09	(1a) x	2.4	(2a) =	177.82	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.09	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	177.82	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Walls Type1	31	12.88	18.12	x	0.18	=	3.26			(29)
Walls Type2	31.26	2.1	29.16	x	0.18	=	5.25			(29)
Roof	19.99	0	19.99	x	0.11	=	2.2			(30)
Total area of elements, m²			82.25							(31)
Party wall			31.88	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	27.98	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		15.16	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	43.13	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(38)m=	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	72.47	72.47	72.47	72.47	72.47	72.47	72.47	72.47	72.47	72.47	72.47	72.47	

Average = $Sum(39)_{1...12}$ /12= 72.47 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	

Average = $Sum(40)_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.34 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.8 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.78	95.19	91.6	88.01	84.42	80.82	80.82	84.42	88.01	91.6	95.19	98.78	

Total = $Sum(44)_{1...12}$ = 1077.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.49	128.12	132.21	115.27	110.6	95.44	88.44	101.49	102.7	119.68	130.64	141.87	

Total = $Sum(45)_{1...12}$ = 1412.96 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.97	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.4	17.95	19.6	21.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.77	178.05	187.49	168.76	165.88	148.93	143.72	156.76	156.19	174.96	184.14	197.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.77	178.05	187.49	168.76	165.88	148.93	143.72	156.76	156.19	174.96	184.14	197.15

Output from water heater (annual)1…12	2063.8	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.93	82.54	88.18	81.12	81	74.53	73.63	77.97	76.94	84.02	86.23	91.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.57	16.49	13.41	10.15	7.59	6.41	6.92	9	12.08	15.34	17.9	19.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	206.65	208.79	203.39	191.89	177.36	163.72	154.6	152.45	157.86	169.36	183.88	197.53	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	(71)

Water heating gains (Table 5)

(72)m=	124.91	122.83	118.52	112.67	108.87	103.51	98.96	104.79	106.86	112.93	119.77	122.84	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	408.24	406.23	393.44	372.82	351.94	331.75	318.6	324.36	334.92	355.74	379.67	397.57	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.6	x	10.63	x	0.5	x	0.8	=	13.56	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.5	x	0.8	=	25.91	(74)

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North	0.9x	0.77	x	4.6	x	34.53	x	0.5	x	0.8	=	44.03	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.5	x	0.8	=	70.72	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.5	x	0.8	=	95.27	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.5	x	0.8	=	101.99	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.5	x	0.8	=	95.22	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.5	x	0.8	=	75.55	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.5	x	0.8	=	52.94	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.5	x	0.8	=	30.84	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.5	x	0.8	=	16.73	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.5	x	0.8	=	11.3	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)

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East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	58.64	114.1	189.26	282.53	354.84	367.71	348.2	292.85	221.84	135.48	72.93	48.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	466.88	520.33	582.7	655.35	706.78	699.46	666.8	617.21	556.76	491.22	452.6	445.95	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.83	0.64	0.47	0.53	0.8	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.03	20.15	20.38	20.66	20.89	20.98	21	20.99	20.93	20.64	20.27	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.78	0.56	0.38	0.43	0.73	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.8	18.98	19.31	19.71	19.99	20.09	20.1	20.1	20.05	19.68	19.16	18.75	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.29	19.45	19.73	20.09	20.35	20.44	20.46	20.46	20.4	20.06	19.6	19.24	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.29	19.45	19.73	20.09	20.35	20.44	20.46	20.46	20.4	20.06	19.6	19.24	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.8	0.59	0.42	0.47	0.76	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	464.77	515.69	569.09	606.69	562.61	413.82	278.55	291.82	420.84	468.21	448.33	444.37	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1086.32	1054.35	959.1	811	626.91	423.58	279.67	294.03	456.59	685.77	906.06	1090.2	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	462.44	361.98	290.17	147.1	47.84	0	0	0	0	161.86	329.57	480.49	

Total per year (kWh/year) = $Sum(98)_{1…5,9…12}$ = 2281.46 (98)

Space heating requirement in kWh/m²/year 30.79 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2281.46	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2395.53	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2063.8	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2166.99	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	45.63	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.94	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	47.94	(331)
Energy for lighting (calculated in Appendix L)		327.88	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	1059.68	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	23.68	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1083.36	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1083.36	(376)

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CO_2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	24.88	(378)
CO_2 associated with electricity for lighting	(332))) x	0.52	=	170.17	(379)
Total CO_2, kg/year	sum of (376)…(382) =			1278.41	(383)
Dwelling CO_2 Emission Rate	(383) ÷ (4) =			17.25	(384)
EI rating (section 14)				85.62	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-10-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.09	(1a) x	2.4	(2a) =	177.82	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.09	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	177.82	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Walls Type1	31	12.88	18.12	x	0.18	=	3.26			(29)
Walls Type2	31.26	2.1	29.16	x	0.18	=	5.25			(29)
Roof	19.99	0	19.99	x	0.13	=	2.6			(30)
Total area of elements, m²			82.25							(31)
Party wall			31.88	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.9 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 43.19 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	35.38	35.15	34.92	33.84	33.63	32.69	32.69	32.52	33.06	33.63	34.04	34.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.57	78.33	78.1	77.02	76.82	75.88	75.88	75.7	76.24	76.82	77.23	77.66	

Average = Sum(39)$_{1...12}$ /12= 77.02 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.06	1.06	1.05	1.04	1.04	1.02	1.02	1.02	1.03	1.04	1.04	1.05

Average = Sum(40)$_{1...12}$ /12= 1.04 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.34 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.8 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	98.78	95.19	91.6	88.01	84.42	80.82	80.82	84.42	88.01	91.6	95.19	98.78

Total = Sum(44)$_{1...12}$ = 1077.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.49	128.12	132.21	115.27	110.6	95.44	88.44	101.49	102.7	119.68	130.64	141.87

Total = Sum(45)$_{1...12}$ = 1412.96 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.97	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.4	17.95	19.6	21.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	193.09	170.21	178.81	160.36	157.2	140.53	135.03	148.08	147.79	166.28	175.74	188.47	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	193.09	170.21	178.81	160.36	157.2	140.53	135.03	148.08	147.79	166.28	175.74	188.47

Output from water heater (annual)$_{1...12}$	1961.57	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.98	76.27	81.24	74.4	74.05	67.81	66.68	71.02	70.22	77.07	79.51	84.45	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.93	16.81	13.67	10.35	7.74	6.53	7.06	9.17	12.31	15.63	18.25	19.45	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	206.65	208.79	203.39	191.89	177.36	163.72	154.6	152.45	157.86	169.36	183.88	197.53	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	(71)

Water heating gains (Table 5)

(72)m=	115.57	113.5	109.19	103.33	99.53	94.18	89.63	95.46	97.53	103.59	110.43	113.51	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	402.26	400.22	387.37	366.69	345.75	325.54	312.4	318.2	328.82	349.7	373.68	391.61	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.6	x	10.63	x	0.63	x	0.7	=	14.95	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.63	x	0.7	=	28.57	(74)

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North	0.9x	0.77	x	4.6	x	34.53	x	0.63	x	0.7	=	48.54	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.63	x	0.7	=	77.97	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.63	x	0.7	=	105.04	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.63	x	0.7	=	112.44	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.63	x	0.7	=	104.98	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.63	x	0.7	=	83.29	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.63	x	0.7	=	58.36	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.63	x	0.7	=	34.01	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.63	x	0.7	=	18.44	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.63	x	0.7	=	12.46	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)

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East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	64.65	125.79	208.65	311.49	391.22	405.4	383.89	322.86	244.58	149.37	80.41	53.33	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	466.91	526.01	596.02	678.17	736.96	730.94	696.29	641.07	573.4	499.07	454.09	444.94	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.83	0.64	0.48	0.53	0.81	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.91	20.05	20.3	20.62	20.87	20.98	21	20.99	20.92	20.59	20.2	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.03	20.04	20.04	20.05	20.05	20.06	20.06	20.07	20.06	20.05	20.05	20.04	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.78	0.56	0.38	0.43	0.73	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.58	18.78	19.14	19.61	19.93	20.05	20.06	20.06	20	19.58	19.01	18.56	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.11	19.29	19.6	20.02	20.3	20.42	20.44	20.43	20.36	19.99	19.48	19.09	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.11	19.29	19.6	20.02	20.3	20.42	20.44	20.43	20.36	19.99	19.48	19.09	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.8	0.59	0.42	0.47	0.76	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	464.82	521.32	582.09	627.33	586.55	430.33	289.66	302.76	435.61	476.39	449.91	443.38	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1163.65	1127.15	1023.51	856.26	660.99	441.57	291.04	305.43	477.62	720.98	956.34	1156.21	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	519.92	407.12	328.42	164.83	55.38	0	0	0	0	181.97	364.63	530.34	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2552.6 (98)

Space heating requirement in kWh/m²/year 34.45 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system			0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =		1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =		1	(204)
Efficiency of main space heating system 1			93.5	(206)
Efficiency of secondary/supplementary heating system, %			0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	519.92	407.12	328.42	164.83	55.38	0	0	0	0	181.97	364.63	530.34		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	556.07	435.42	351.25	176.28	59.23	0	0	0	0	194.62	389.98	567.21		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2730.06	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	193.09	170.21	178.81	160.36	157.2	140.53	135.03	148.08	147.79	166.28	175.74	188.47		
Efficiency of water heater													79.8	(216)
(217)m=	87.33	87.06	86.42	84.89	82.34	79.8	79.8	79.8	79.8	85.05	86.72	87.43		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	221.1	195.51	206.92	188.91	190.92	176.1	169.22	185.56	185.2	195.5	202.65	215.57		
Total = Sum(219a)$_{1...12}$ =													2333.16	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2730.06	
Water heating fuel used			2333.16	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			334.23	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	589.69	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	503.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1093.66	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	173.47	(268)
Total CO2, kg/year		sum of (265)…(271) =		1306.05	(272)

TER = 17.63 (273)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version: Version: 1.0.4.8

Property Address: b2-10-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	75.18	(1a)	x	2.4	(2a)	=	180.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.18	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			180.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 4			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Walls Type1	41.41	15.41	26	x	0.18	=	4.68			(29)
Walls Type2	4.86	2.1	2.76	x	0.18	=	0.5			(29)
Roof	75.18	0	75.18	x	0.11	=	8.27			(30)
Total area of elements, m²			121.45							(31)
Party wall			42	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	33.61	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		15.28	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	48.9	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.67	78.67	78.67	78.67	78.67	78.67	78.67	78.67	78.67	78.67	78.67	78.67	

Average = Sum(39)$_{1...12}$ /12= 78.67 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	

Average = Sum(40)$_{1...12}$ /12= 1.05 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.37 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.37 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	99.41	95.79	92.18	88.56	84.95	81.33	81.33	84.95	88.56	92.18	95.79	99.41	

Total = Sum(44)$_{1...12}$ = 1084.44 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.42	128.93	133.05	115.99	111.3	96.04	89	102.13	103.35	120.44	131.47	142.77	

Total = Sum(45)$_{1...12}$ = 1421.87 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.11	19.34	19.96	17.4	16.69	14.41	13.35	15.32	15.5	18.07	19.72	21.41	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3												0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.69	178.86	188.32	169.49	166.58	149.54	144.27	157.4	156.84	175.72	184.96	198.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.69	178.86	188.32	169.49	166.58	149.54	144.27	157.4	156.84	175.72	184.96	198.04	
Output from water heater (annual)$_{1...12}$												2072.71	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.24	82.81	88.46	81.36	81.23	74.73	73.81	78.18	77.16	84.27	86.51	91.69	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	18.64	16.56	13.46	10.19	7.62	6.43	6.95	9.03	12.13	15.4	17.97	19.16	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	209.07	211.24	205.78	194.14	179.44	165.64	156.41	154.24	159.71	171.35	186.04	199.85	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	(71)
Water heating gains (Table 5)													
(72)m=	125.32	123.23	118.9	113	109.18	103.79	99.21	105.08	107.16	113.26	120.15	123.24	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	411.51	409.51	396.61	375.81	354.72	334.33	321.05	326.83	337.47	358.48	382.64	400.72	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(76)
East	0.9x	1	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(76)

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East	0.9x	1	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(76)
East	0.9x	1	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(76)
East	0.9x	1	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(76)
East	0.9x	1	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(76)
East	0.9x	1	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(76)
East	0.9x	1	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(76)
East	0.9x	1	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(76)
East	0.9x	1	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(76)
East	0.9x	1	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(76)
East	0.9x	1	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)

South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	159.95	271.13	366.39	444.56	488.08	479.88	464.62	433.09	393.73	298.53	191.37	137.01	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	571.46	680.64	763	820.36	842.8	814.22	785.67	759.92	731.2	657.01	574.01	537.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.78	0.6	0.44	0.47	0.7	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.05	20.24	20.48	20.73	20.9	20.98	21	21	20.96	20.73	20.33	20	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.87	0.72	0.52	0.34	0.38	0.62	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.79	19.07	19.41	19.74	19.96	20.03	20.04	20.04	20.02	19.75	19.19	18.72	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.3	19.54	19.84	20.14	20.34	20.41	20.43	20.42	20.39	20.14	19.65	19.23	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.3	19.54	19.84	20.14	20.34	20.41	20.43	20.42	20.39	20.14	19.65	19.23	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.94	0.87	0.74	0.55	0.38	0.41	0.65	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	565.63	663.99	720.52	717.04	624.81	448.25	299.89	314.97	474.04	587.84	560.92	533.62	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1179.65	1151.32	1049.07	883.95	679.4	457.24	300.91	316.57	495.02	750.66	987.13	1182.36	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	456.83	327.48	244.44	120.17	40.62	0	0	0	0	121.14	306.87	482.66	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = | 2100.22 | (98)

Space heating requirement in kWh/m²/year | 27.94 | (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.			
Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2100.22	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2205.23	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2072.71	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2176.35	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.82	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		48.65	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	48.65	(331)
Energy for lighting (calculated in Appendix L)		329.17	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1017.66	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	22.74	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1040.4	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1040.4	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	25.25	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	170.84	(379)
Total CO2, kg/year	sum of (376)…(382) =			1236.49	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.45	(384)
EI rating (section 14)				86.21	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-10-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	75.18	(1a) x	2.4	(2a) =	180.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.18	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	180.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 4			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Walls Type1	41.41	15.41	26	x	0.18	=	4.68			(29)
Walls Type2	4.86	2.1	2.76	x	0.18	=	0.5			(29)
Roof	75.18	0	75.18	x	0.13	=	9.77			(30)
Total area of elements, m²			121.45							(31)
Party wall			42	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.48 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.92 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 52.4 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	35.83	35.6	35.36	34.28	34.08	33.14	33.14	32.96	33.5	34.08	34.49	34.92	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.23	87.99	87.76	86.68	86.48	85.53	85.53	85.36	85.9	86.48	86.89	87.32	

Average = Sum(39)$_{1...12}$ /12= 86.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.17	1.17	1.17	1.15	1.15	1.14	1.14	1.14	1.14	1.15	1.16	1.16	

Average = Sum(40)$_{1...12}$ /12= 1.15 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.37 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.37 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	99.41	95.79	92.18	88.56	84.95	81.33	81.33	84.95	88.56	92.18	95.79	99.41	

Total = Sum(44)$_{1...12}$ = 1084.44 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.42	128.93	133.05	115.99	111.3	96.04	89	102.13	103.35	120.44	131.47	142.77	

Total = Sum(45)$_{1...12}$ = 1421.87 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.11	19.34	19.96	17.4	16.69	14.41	13.35	15.32	15.5	18.07	19.72	21.41	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	194.01	171.02	179.64	161.09	157.89	141.13	135.59	148.72	148.44	167.03	176.56	189.36	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	194.01	171.02	179.64	161.09	157.89	141.13	135.59	148.72	148.44	167.03	176.56	189.36	

Output from water heater (annual)$_{1…12}$	1970.49	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.29	76.54	81.51	74.64	74.28	68.01	66.87	71.23	70.44	77.32	79.79	84.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.73	16.63	13.53	10.24	7.65	6.46	6.98	9.08	12.18	15.47	18.05	19.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	209.07	211.24	205.78	194.14	179.44	165.64	156.41	154.24	159.71	171.35	186.04	199.85	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	(71)

Water heating gains (Table 5)

(72)m=	115.98	113.9	109.56	103.67	99.84	94.45	89.88	95.74	97.83	103.93	110.81	113.91	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	405.26	403.25	390.34	369.52	348.42	328.03	314.75	320.54	331.2	352.22	376.39	394.48	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.29	x	19.64	x	0.63	x	0.7	=	31.75	(76)
East	0.9x	1	x	5.29	x	38.42	x	0.63	x	0.7	=	62.11	(76)

East	0.9x	1	x	5.29	x	63.27	x	0.63	x	0.7	=	102.29	(76)
East	0.9x	1	x	5.29	x	92.28	x	0.63	x	0.7	=	149.19	(76)
East	0.9x	1	x	5.29	x	113.09	x	0.63	x	0.7	=	182.84	(76)
East	0.9x	1	x	5.29	x	115.77	x	0.63	x	0.7	=	187.17	(76)
East	0.9x	1	x	5.29	x	110.22	x	0.63	x	0.7	=	178.19	(76)
East	0.9x	1	x	5.29	x	94.68	x	0.63	x	0.7	=	153.06	(76)
East	0.9x	1	x	5.29	x	73.59	x	0.63	x	0.7	=	118.97	(76)
East	0.9x	1	x	5.29	x	45.59	x	0.63	x	0.7	=	73.7	(76)
East	0.9x	1	x	5.29	x	24.49	x	0.63	x	0.7	=	39.59	(76)
East	0.9x	1	x	5.29	x	16.15	x	0.63	x	0.7	=	26.11	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.63	x	0.7	=	65.72	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.63	x	0.7	=	107.64	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.63	x	0.7	=	137.12	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.63	x	0.7	=	154.97	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.63	x	0.7	=	161.49	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.63	x	0.7	=	155.41	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.63	x	0.7	=	151.85	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.63	x	0.7	=	147.46	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.63	x	0.7	=	143.23	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.63	x	0.7	=	116.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)

South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.63	x	0.7	=	77.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.63	x	0.7	=	56.79	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	176.35	298.92	403.95	490.12	538.11	529.07	512.25	477.48	434.08	329.12	210.99	151.05	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	581.61	702.17	794.29	859.64	886.53	857.1	826.99	798.02	765.28	681.34	587.37	545.53	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.79	0.61	0.45	0.49	0.71	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.89	20.1	20.37	20.66	20.87	20.97	21	20.99	20.94	20.66	20.22	19.85	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.94	19.94	19.95	19.96	19.96	19.97	19.97	19.97	19.97	19.96	19.96	19.95	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.88	0.73	0.53	0.35	0.38	0.63	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.48	18.78	19.17	19.58	19.84	19.95	19.97	19.97	19.92	19.6	18.97	18.43	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.04	19.31	19.65	20.01	20.25	20.36	20.38	20.38	20.33	20.02	19.47	19	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.04	19.31	19.65	20.01	20.25	20.36	20.38	20.38	20.33	20.02	19.47	19	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.88	0.75	0.56	0.39	0.42	0.66	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	575.55	684.9	750.86	754.25	665.44	479.64	321.56	337.07	505.4	612.52	574.06	541.23	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1300.62	1267.93	1153.93	963.33	739.71	492.76	323.25	339.63	535.27	814.98	1074.48	1292.04	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	539.46	391.79	299.88	150.53	55.26	0	0	0	0	150.63	360.3	558.61	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = | 2506.46 | (98)

Space heating requirement in kWh/m²/year | 33.34 | (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system			0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =		1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =		1	(204)
Efficiency of main space heating system 1			93.5	(206)
Efficiency of secondary/supplementary heating system, %			0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	539.46	391.79	299.88	150.53	55.26	0	0	0	0	150.63	360.3	558.61		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	576.96	419.03	320.73	161	59.1	0	0	0	0	161.1	385.34	597.44		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2680.7	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	194.01	171.02	179.64	161.09	157.89	141.13	135.59	148.72	148.44	167.03	176.56	189.36		
Efficiency of water heater													79.8	(216)
(217)m=	87.4	86.96	86.17	84.63	82.32	79.8	79.8	79.8	79.8	84.54	86.68	87.53		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	221.98	196.67	208.47	190.33	191.8	176.86	169.91	186.37	186.01	197.58	203.7	216.34		
Total = Sum(219a)$_{1...12}$ =													2346.02	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2680.7	
Water heating fuel used			2346.02	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			330.71	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	579.03	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	506.74	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1085.77	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	171.64	(268)
Total CO2, kg/year		sum of (265)…(271) =		1296.33	(272)

TER = 17.24 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-10-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	66.83	(1a) x	2.4	(2a) =	160.39	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	66.83	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	160.39	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			6.9	x1/[1/(1.2)+ 0.04]		=	7.9			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	37.48	14.26	23.22	x	0.18	=	4.18			(29)
Walls Type2	25.22	2.1	23.12	x	0.18	=	4.16			(29)
Roof	66.83	0	66.83	x	0.11	=	7.35			(30)
Total area of elements, m²			129.53							(31)
Party wall			19.67	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.54 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 13.8 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 48.34 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26.46	26.46	26.46	26.46	26.46	26.46	26.46	26.46	26.46	26.46	26.46	26.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	74.81	74.81	74.81	74.81	74.81	74.81	74.81	74.81	74.81	74.81	74.81	74.81	

Average = $Sum(39)_{1...12}$ /12= 74.81 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	

Average = $Sum(40)_{1...12}$ /12= 1.12 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.17 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 85.66 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	94.23	90.8	87.37	83.95	80.52	77.09	77.09	80.52	83.95	87.37	90.8	94.23	

Total = $Sum(44)_{1...12}$ = 1027.93 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	139.74	122.21	126.11	109.95	105.5	91.04	84.36	96.8	97.96	114.16	124.62	135.33	

Total = $Sum(45)_{1...12}$ = 1347.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.96	18.33	18.92	16.49	15.82	13.66	12.65	14.52	14.69	17.12	18.69	20.3	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	195.01	172.14	181.39	163.44	160.78	144.53	139.64	152.08	151.45	169.44	178.11	190.6	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	195.01	172.14	181.39	163.44	160.78	144.53	139.64	152.08	151.45	169.44	178.11	190.6	

Output from water heater (annual)$_{1...12}$	1998.62	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.68	80.58	86.15	79.35	79.3	73.06	72.27	76.41	75.37	82.18	84.23	89.22	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	16.92	15.03	12.22	9.25	6.92	5.84	6.31	8.2	11.01	13.98	16.31	17.39	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	189.79	191.76	186.79	176.23	162.89	150.36	141.98	140.01	144.98	155.54	168.88	181.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	(71)

Water heating gains (Table 5)

(72)m=	121.89	119.91	115.8	110.21	106.59	101.48	97.14	102.7	104.68	110.46	116.99	119.92	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	384.1	382.2	370.32	351.2	331.9	313.18	300.93	306.42	316.16	335.48	357.68	374.22	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	6.9	x	46.75	x	0.5	x	0.8	=	89.42	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)

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South	0.9x	0.77	x	6.9	x	76.57	x	0.5	x	0.8	=	146.45	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	6.9	x	97.53	x	0.5	x	0.8	=	186.55	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	6.9	x	110.23	x	0.5	x	0.8	=	210.84	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	6.9	x	114.87	x	0.5	x	0.8	=	219.71	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	6.9	x	110.55	x	0.5	x	0.8	=	211.44	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	6.9	x	108.01	x	0.5	x	0.8	=	206.59	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	6.9	x	104.89	x	0.5	x	0.8	=	200.63	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	6.9	x	101.89	x	0.5	x	0.8	=	194.87	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	6.9	x	82.59	x	0.5	x	0.8	=	157.96	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	6.9	x	55.42	x	0.5	x	0.8	=	106	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	6.9	x	40.4	x	0.5	x	0.8	=	77.27	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)

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West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	150.23	254.02	341.85	412.85	451.8	443.64	429.77	401.6	366.66	279.28	179.62	128.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	534.33	636.22	712.17	764.05	783.7	756.82	730.7	708.02	682.82	614.75	537.3	502.99	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.78	0.61	0.45	0.48	0.7	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.98	20.18	20.43	20.69	20.88	20.97	21	20.99	20.95	20.7	20.28	19.93	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.87	0.73	0.52	0.35	0.38	0.62	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.65	18.93	19.29	19.64	19.88	19.97	19.98	19.98	19.95	19.66	19.08	18.57	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.18	19.43	19.75	20.06	20.28	20.37	20.39	20.39	20.35	20.08	19.56	19.12	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.18	19.43	19.75	20.06	20.28	20.37	20.39	20.39	20.35	20.08	19.56	19.12	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.87	0.74	0.56	0.39	0.42	0.65	0.89	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	527.86	618.72	669.86	666.12	582.94	421.03	282.06	296.22	444.1	547.36	523.37	498.35	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1113.49	1087.21	990.87	835.06	641.97	431.76	283.4	298.27	467.44	708.86	931.89	1115.92	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	435.71	314.82	238.83	121.64	43.92	0	0	0	0	120.15	294.13	459.47	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = | 2028.68 | (98)

Space heating requirement in kWh/m²/year | 30.36 | (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2028.68	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2130.11	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1998.62	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2098.55	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	42.29	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		43.24	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	43.24	(331)
Energy for lighting (calculated in Appendix L)		298.81	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	982.14	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	21.95	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1004.09	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1004.09	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	22.44	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	155.08	(379)
Total CO2, kg/year	sum of (376)…(382) =			1181.61	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			17.68	(384)
EI rating (section 14)				85.84	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b2-10-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	66.83	(1a) x	2.4	(2a) =	160.39	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	66.83	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	160.39	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.37	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.32	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			6.9	x1/[1/(1.4)+ 0.04]		=	9.15			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Walls Type1	37.48	14.26	23.22	x	0.18	=	4.18			(29)
Walls Type2	25.22	2.1	23.12	x	0.18	=	4.16			(29)
Roof	66.83	0	66.83	x	0.13	=	8.69			(30)
Total area of elements, m²			129.53							(31)
Party wall			19.67	x	0	=	0			(32)

* *for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
** *include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.03 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.23 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 52.27 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	30.83	30.66	30.49	29.71	29.57	28.89	28.89	28.76	29.15	29.57	29.86	30.17	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	83.1	82.93	82.76	81.98	81.83	81.15	81.15	81.03	81.42	81.83	82.13	82.44	

Average = Sum(39)$_{1…12}$ /12= 81.98 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.24	1.24	1.24	1.23	1.22	1.21	1.21	1.21	1.22	1.22	1.23	1.23	

Average = Sum(40)$_{1…12}$ /12= 1.23 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.17 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 85.66 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	94.23	90.8	87.37	83.95	80.52	77.09	77.09	80.52	83.95	87.37	90.8	94.23	

Total = Sum(44)$_{1…12}$ = 1027.93 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	139.74	122.21	126.11	109.95	105.5	91.04	84.36	96.8	97.96	114.16	124.62	135.33	

Total = Sum(45)$_{1…12}$ = 1347.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.96	18.33	18.92	16.49	15.82	13.66	12.65	14.52	14.69	17.12	18.69	20.3	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	186.33	164.3	172.71	155.04	152.09	136.13	130.95	143.4	143.05	160.76	169.71	181.92	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	186.33	164.3	172.71	155.04	152.09	136.13	130.95	143.4	143.05	160.76	169.71	181.92

Output from water heater (annual)1…12	1896.4	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	83.74	74.3	79.21	72.63	72.35	66.34	65.33	69.46	68.65	75.24	77.51	82.27	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	16.95	15.05	12.24	9.27	6.93	5.85	6.32	8.22	11.03	14	16.34	17.42	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	189.79	191.76	186.79	176.23	162.89	150.36	141.98	140.01	144.98	155.54	168.88	181.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	(71)

Water heating gains (Table 5)

(72)m=	112.55	110.57	106.46	100.88	97.25	92.14	87.8	93.36	95.34	101.12	107.65	110.58	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	377.79	375.89	364	344.88	325.57	306.85	294.61	300.1	309.85	329.17	351.37	367.92	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	6.9	x	46.75	x	0.63	x	0.7	=	98.59	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)

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South	0.9x	0.77	x	6.9	x	76.57	x	0.63	x	0.7	=	161.46	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	6.9	x	97.53	x	0.63	x	0.7	=	205.67	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	6.9	x	110.23	x	0.63	x	0.7	=	232.45	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	6.9	x	114.87	x	0.63	x	0.7	=	242.23	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	6.9	x	110.55	x	0.63	x	0.7	=	233.12	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	6.9	x	108.01	x	0.63	x	0.7	=	227.77	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	6.9	x	104.89	x	0.63	x	0.7	=	221.19	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	6.9	x	101.89	x	0.63	x	0.7	=	214.85	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	6.9	x	82.59	x	0.63	x	0.7	=	174.15	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	6.9	x	55.42	x	0.63	x	0.7	=	116.86	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	6.9	x	40.4	x	0.63	x	0.7	=	85.19	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)

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West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	165.63	280.06	376.89	455.17	498.11	489.11	473.82	442.77	404.24	307.9	198.03	141.97	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	543.42	655.94	740.89	800.04	823.69	795.97	768.43	742.87	714.09	637.07	549.4	509.89	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.79	0.62	0.46	0.49	0.72	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.83	20.04	20.32	20.63	20.85	20.96	20.99	20.99	20.93	20.63	20.17	19.78	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.89	19.89	19.89	19.9	19.9	19.91	19.91	19.91	19.91	19.9	19.9	19.89	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.87	0.73	0.53	0.35	0.38	0.63	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.35	18.67	19.06	19.49	19.76	19.89	19.91	19.91	19.86	19.51	18.85	18.3	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.94	19.22	19.57	19.94	20.2	20.32	20.34	20.34	20.29	19.96	19.38	18.89	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.94	19.22	19.57	19.94	20.2	20.32	20.34	20.34	20.29	19.96	19.38	18.89	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.87	0.75	0.56	0.39	0.43	0.66	0.89	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	536.68	637.61	697.01	698.94	618.2	448.98	301.49	316.13	471.62	569.25	535.15	505.02	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1216.79	1187.38	1081.43	905.17	695.45	464.05	303.6	319.26	503.61	765.88	1008.51	1211.16	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	506	369.45	286.01	148.49	57.48	0	0	0	0	146.29	340.82	525.37	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 2379.9 (98)

Space heating requirement in kWh/m²/year 35.61 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	506	369.45	286.01	148.49	57.48	0	0	0	0	146.29	340.82	525.37		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	541.18	395.13	305.89	158.81	61.48	0	0	0	0	156.46	364.51	561.89		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													2545.35	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	186.33	164.3	172.71	155.04	152.09	136.13	130.95	143.4	143.05	160.76	169.71	181.92		
Efficiency of water heater													79.8	(216)
(217)m=	87.35	86.91	86.15	84.7	82.47	79.8	79.8	79.8	79.8	84.56	86.64	87.48		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	213.32	189.04	200.47	183.05	184.41	170.59	164.1	179.7	179.26	190.1	195.88	207.95		
Total = Sum(219a)$_{1...12}$ =													2257.88	(219)

Annual totals **kWh/year** **kWh/year**

Space heating fuel used, main system 1			2545.35	
Water heating fuel used			2257.88	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			299.32	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	549.8	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	487.7	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1037.5	(265)

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Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	155.35	(268)
Total CO2, kg/year			sum of (265)…(271) =		1231.77	(272)

TER =	18.43	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-10-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	49.58	(1a) x	2.4	(2a) =	118.99	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.58	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	118.99	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			6.8	x1/[1/(1.2)+ 0.04]		=	7.79			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	29.01	13.24	15.77	x	0.18	=	2.84			(29)
Walls Type2	27.91	2.1	25.81	x	0.18	=	4.65			(29)
Total area of elements, m²			56.92							(31)
Party wall			15.1	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.16 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.35 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 34.51 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	54.15	54.15	54.15	54.15	54.15	54.15	54.15	54.15	54.15	54.15	54.15	54.15	

Average = $Sum(39)_{1…12}$ /12= 54.15 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09

Average = Sum(40)$_{1...12}$ /12= 1.09 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.68 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	81.45	78.49	75.53	72.57	69.6	66.64	66.64	69.6	72.57	75.53	78.49	81.45	
										Total = Sum(44)$_{1...12}$ =		888.56	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	120.79	105.64	109.01	95.04	91.19	78.69	72.92	83.68	84.68	98.68	107.72	116.98	
										Total = Sum(45)$_{1...12}$ =		1165.04	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.12	15.85	16.35	14.26	13.68	11.8	10.94	12.55	12.7	14.8	16.16	17.55	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	176.07	155.57	164.29	148.54	146.47	132.19	128.2	138.96	138.17	153.96	161.21	172.25	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	176.07	155.57	164.29	148.54	146.47	132.19	128.2	138.96	138.17	153.96	161.21	172.25

Output from water heater (annual)$_{1...12}$ 1815.88 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.38	75.07	80.47	74.4	74.54	68.96	68.47	72.04	70.95	77.03	78.61	83.12	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	13.03	11.57	9.41	7.12	5.33	4.5	4.86	6.32	8.48	10.76	12.56	13.39	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	146.14	147.66	143.84	135.7	125.43	115.78	109.33	107.82	111.64	119.77	130.04	139.69	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	(71)
Water heating gains (Table 5)													
(72)m=	113.42	111.71	108.16	103.33	100.19	95.78	92.03	96.83	98.54	103.54	109.18	111.72	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	320.76	319.11	309.57	294.32	279.12	264.22	254.38	259.13	266.82	282.24	299.95	312.97	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)

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South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
West	0.9x	0.77	x	6.8	x	19.64	x	0.5	x	0.8	=	37.02	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	6.8	x	38.42	x	0.5	x	0.8	=	72.42	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	6.8	x	63.27	x	0.5	x	0.8	=	119.27	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	6.8	x	92.28	x	0.5	x	0.8	=	173.94	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	6.8	x	113.09	x	0.5	x	0.8	=	213.18	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	6.8	x	115.77	x	0.5	x	0.8	=	218.22	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	6.8	x	110.22	x	0.5	x	0.8	=	207.76	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	6.8	x	94.68	x	0.5	x	0.8	=	178.46	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	6.8	x	73.59	x	0.5	x	0.8	=	138.71	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	6.8	x	45.59	x	0.5	x	0.8	=	85.93	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	6.8	x	24.49	x	0.5	x	0.8	=	46.16	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	6.8	x	16.15	x	0.5	x	0.8	=	30.44	(80)

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West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	85.91	160.47	249.7	347.84	415.97	422.23	403.39	352.68	284.51	186.19	105.65	71.64	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	406.67	479.57	559.27	642.16	695.09	686.45	657.77	611.82	551.34	468.43	405.61	384.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) — 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.85	0.68	0.5	0.36	0.4	0.65	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.23	20.51	20.79	20.94	20.99	21	21	20.97	20.73	20.32	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.81	0.62	0.42	0.28	0.32	0.57	0.87	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.75	19.02	19.41	19.78	19.96	20	20.01	20.01	19.98	19.73	19.16	18.68	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.63	19.96	20.28	20.45	20.5	20.5	20.5	20.48	20.23	19.74	19.33	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.63	19.96	20.28	20.45	20.5	20.5	20.5	20.48	20.23	19.74	19.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.93	0.82	0.65	0.46	0.32	0.36	0.6	0.88	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	401.33	465.67	519.08	527.91	451.54	316.15	210.95	221.41	333.5	412.75	394.52	380.7	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	817.39	797.43	728.88	616.46	473.84	319.27	211.32	222.11	345.24	521.44	684.36	819.44	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	309.55	222.94	156.09	63.75	16.59	0	0	0	0	80.87	208.69	326.43	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 1384.9 (98)

Space heating requirement in kWh/m²/year — 27.93 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1384.9	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1454.15	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1815.88	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1906.67	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	33.61	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		32.08	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	32.08	(331)
Energy for lighting (calculated in Appendix L)		230.09	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	780.58	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	17.44	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	798.02	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				798.02	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	16.65	(378)

CO2 associated with electricity for lighting	(332))) x	0.52	=	119.42	(379)
Total CO2, kg/year	sum of (376)…(382) =			934.09	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.84	(384)
EI rating (section 14)				86.77	(385)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version: Version: 1.0.4.8

Property Address: b2-10-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	49.58	(1a) x	2.4	(2a) =	118.99	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.58	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	118.99	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 2			1.43	x1/[1/(1.4)+ 0.04]		=	1.9			(27)
Windows Type 3			2.15	x1/[1/(1.4)+ 0.04]		=	2.85			(27)
Windows Type 4			1.43	x1/[1/(1.4)+ 0.04]		=	1.9			(27)
Walls Type1	29.01	10.3	18.71	x	0.18	=	3.37			(29)
Walls Type2	27.91	2.1	25.81	x	0.18	=	4.65			(29)
Total area of elements, m²			56.92							(31)
Party wall			15.1	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 23.77 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.15 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 30.92 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	23.66	23.51	23.35	22.63	22.5	21.87	21.87	21.76	22.11	22.5	22.77	23.06	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	54.58	54.43	54.27	53.55	53.42	52.79	52.79	52.68	53.03	53.42	53.69	53.98	

Average = Sum(39)$_{1…12}$ /12= 53.55 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.1	1.1	1.09	1.08	1.08	1.06	1.06	1.06	1.07	1.08	1.08	1.09	

Average = Sum(40)$_{1\ldots12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.68 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	81.45	78.49	75.53	72.57	69.6	66.64	66.64	69.6	72.57	75.53	78.49	81.45	

Total = Sum(44)$_{1\ldots12}$ = 888.56 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	120.79	105.64	109.01	95.04	91.19	78.69	72.92	83.68	84.68	98.68	107.72	116.98	

Total = Sum(45)$_{1\ldots12}$ = 1165.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	18.12	15.85	16.35	14.26	13.68	11.8	10.94	12.55	12.7	14.8	16.16	17.55	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	167.38	147.73	155.61	140.13	137.79	123.79	119.52	130.27	129.77	145.28	152.81	163.57	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	167.38	147.73	155.61	140.13	137.79	123.79	119.52	130.27	129.77	145.28	152.81	163.57	

Output from water heater (annual)$_{1...12}$ 1713.66 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.44	68.79	73.52	67.67	67.6	62.24	61.52	65.1	64.23	70.09	71.89	76.17	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.07	11.61	9.44	7.15	5.34	4.51	4.88	6.34	8.51	10.8	12.61	13.44	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	146.14	147.66	143.84	135.7	125.43	115.78	109.33	107.82	111.64	119.77	130.04	139.69	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	(71)

Water heating gains (Table 5)

(72)m=	104.08	102.37	98.82	93.99	90.86	86.44	82.69	87.5	89.21	94.2	99.85	102.38	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	314.47	312.81	303.27	288.01	272.8	257.9	248.07	252.82	260.52	275.94	293.66	306.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	1.43	x	46.75	x	0.63	x	0.7	=	20.43	(78)
South	0.9x	0.77	x	1.43	x	76.57	x	0.63	x	0.7	=	33.46	(78)
South	0.9x	0.77	x	1.43	x	97.53	x	0.63	x	0.7	=	42.62	(78)
South	0.9x	0.77	x	1.43	x	110.23	x	0.63	x	0.7	=	48.18	(78)
South	0.9x	0.77	x	1.43	x	114.87	x	0.63	x	0.7	=	50.2	(78)

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South	0.9x	0.77	x	1.43	x	110.55	x	0.63	x	0.7	=	48.31	(78)
South	0.9x	0.77	x	1.43	x	108.01	x	0.63	x	0.7	=	47.2	(78)
South	0.9x	0.77	x	1.43	x	104.89	x	0.63	x	0.7	=	45.84	(78)
South	0.9x	0.77	x	1.43	x	101.89	x	0.63	x	0.7	=	44.53	(78)
South	0.9x	0.77	x	1.43	x	82.59	x	0.63	x	0.7	=	36.09	(78)
South	0.9x	0.77	x	1.43	x	55.42	x	0.63	x	0.7	=	24.22	(78)
South	0.9x	0.77	x	1.43	x	40.4	x	0.63	x	0.7	=	17.66	(78)
West	0.9x	0.77	x	5.29	x	19.64	x	0.63	x	0.7	=	31.75	(80)
West	0.9x	0.77	x	1.43	x	19.64	x	0.63	x	0.7	=	8.58	(80)
West	0.9x	0.77	x	2.15	x	19.64	x	0.63	x	0.7	=	12.9	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.63	x	0.7	=	62.11	(80)
West	0.9x	0.77	x	1.43	x	38.42	x	0.63	x	0.7	=	16.79	(80)
West	0.9x	0.77	x	2.15	x	38.42	x	0.63	x	0.7	=	25.24	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.63	x	0.7	=	102.29	(80)
West	0.9x	0.77	x	1.43	x	63.27	x	0.63	x	0.7	=	27.65	(80)
West	0.9x	0.77	x	2.15	x	63.27	x	0.63	x	0.7	=	41.57	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.63	x	0.7	=	149.19	(80)
West	0.9x	0.77	x	1.43	x	92.28	x	0.63	x	0.7	=	40.33	(80)
West	0.9x	0.77	x	2.15	x	92.28	x	0.63	x	0.7	=	60.63	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.63	x	0.7	=	182.84	(80)
West	0.9x	0.77	x	1.43	x	113.09	x	0.63	x	0.7	=	49.42	(80)
West	0.9x	0.77	x	2.15	x	113.09	x	0.63	x	0.7	=	74.31	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.63	x	0.7	=	187.17	(80)
West	0.9x	0.77	x	1.43	x	115.77	x	0.63	x	0.7	=	50.59	(80)
West	0.9x	0.77	x	2.15	x	115.77	x	0.63	x	0.7	=	76.07	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.63	x	0.7	=	178.19	(80)
West	0.9x	0.77	x	1.43	x	110.22	x	0.63	x	0.7	=	48.17	(80)
West	0.9x	0.77	x	2.15	x	110.22	x	0.63	x	0.7	=	72.42	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.63	x	0.7	=	153.06	(80)
West	0.9x	0.77	x	1.43	x	94.68	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	2.15	x	94.68	x	0.63	x	0.7	=	62.21	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.63	x	0.7	=	118.97	(80)
West	0.9x	0.77	x	1.43	x	73.59	x	0.63	x	0.7	=	32.16	(80)
West	0.9x	0.77	x	2.15	x	73.59	x	0.63	x	0.7	=	48.35	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.63	x	0.7	=	73.7	(80)
West	0.9x	0.77	x	1.43	x	45.59	x	0.63	x	0.7	=	19.92	(80)
West	0.9x	0.77	x	2.15	x	45.59	x	0.63	x	0.7	=	29.96	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.63	x	0.7	=	39.59	(80)
West	0.9x	0.77	x	1.43	x	24.49	x	0.63	x	0.7	=	10.7	(80)
West	0.9x	0.77	x	2.15	x	24.49	x	0.63	x	0.7	=	16.09	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.63	x	0.7	=	26.11	(80)

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West	0.9x	0.77	x	1.43	x	16.15	x	0.63	x	0.7	=	7.06	(80)
West	0.9x	0.77	x	2.15	x	16.15	x	0.63	x	0.7	=	10.61	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	73.67	137.61	214.14	298.33	356.77	362.14	345.98	302.49	244.01	159.67	90.6	61.44	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	388.14	450.42	517.42	586.34	629.57	620.04	594.05	555.31	504.53	435.62	384.27	368.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.88	0.73	0.54	0.39	0.43	0.68	0.92	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.17	20.44	20.75	20.93	20.99	21	21	20.96	20.71	20.29	19.96	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20	20.01	20.02	20.02	20.03	20.03	20.03	20.03	20.02	20.01	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.85	0.67	0.46	0.3	0.34	0.6	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.68	18.94	19.32	19.74	19.95	20.02	20.03	20.03	20	19.7	19.12	18.64	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.34	19.55	19.88	20.24	20.44	20.51	20.51	20.51	20.48	20.2	19.71	19.3	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.34	19.55	19.88	20.24	20.44	20.51	20.51	20.51	20.48	20.2	19.71	19.3	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.94	0.86	0.7	0.5	0.35	0.39	0.64	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	383.95	440.19	488.69	501.57	437.68	307.79	206.13	215.83	323.89	392.63	375.64	364.99	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	820.75	797.61	726.37	607.48	466.88	311.76	206.61	216.69	338.28	513.02	677.04	815.21	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	324.98	240.19	176.84	76.26	21.73	0	0	0	0	89.57	217	334.96	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 1481.53 (98)

Space heating requirement in kWh/m²/year 29.88 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	324.98	240.19	176.84	76.26	21.73	0	0	0	0	89.57	217	334.96		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	347.57	256.89	189.13	81.56	23.24	0	0	0	0	95.79	232.09	358.25		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1584.52	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)
Water heating														
Output from water heater (calculated above)	167.38	147.73	155.61	140.13	137.79	123.79	119.52	130.27	129.77	145.28	152.81	163.57		
Efficiency of water heater													79.8	(216)
(217)m=	86.55	86.1	85.16	83.27	81.11	79.8	79.8	79.8	79.8	83.57	85.75	86.69		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	193.39	171.57	182.74	168.29	169.89	155.12	149.77	163.25	162.62	173.84	178.21	188.7		
Total = Sum(219a)$_{1...12}$ =													2057.38	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1584.52	
Water heating fuel used			2057.38	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			230.91	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	342.26	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	444.39	(264)
Space and water heating	(261) + (262) + (263) + (264) =				786.65	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	119.84	(268)

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Total CO2, kg/year	sum of (265)…(271) =	945.42	(272)
TER =		19.07	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-11-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	58.5	(1a) x	2.4	(2a) =	140.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	58.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	140.4	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	40.78	12.88	27.9	x	0.18	=	5.02			(29)
Walls Type2	29.77	2.1	27.67	x	0.18	=	4.98			(29)
Total area of elements, m²			70.55							(31)
Party wall			11.01	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 27.27 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.36 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 38.63 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	23.17	23.17	23.17	23.17	23.17	23.17	23.17	23.17	23.17	23.17	23.17	23.17	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	61.8	61.8	61.8	61.8	61.8	61.8	61.8	61.8	61.8	61.8	61.8	61.8

Average = Sum(39)$_{1…12}$ /12= 61.8 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06

Average = Sum(40)$_{1...12}$ /12= 1.06 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.94 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 80.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	88.27	85.06	81.85	78.64	75.43	72.22	72.22	75.43	78.64	81.85	85.06	88.27	
										Total = Sum(44)$_{1...12}$ =		962.99	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	130.91	114.49	118.15	103	98.83	85.29	79.03	90.69	91.77	106.95	116.75	126.78	
										Total = Sum(45)$_{1...12}$ =		1262.64	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	19.64	17.17	17.72	15.45	14.83	12.79	11.85	13.6	13.77	16.04	17.51	19.02	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	186.19	164.42	173.42	156.5	154.11	138.78	134.31	145.97	145.27	162.23	170.24	182.05	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	186.19	164.42	173.42	156.5	154.11	138.78	134.31	145.97	145.27	162.23	170.24	182.05	

Output from water heater (annual)$_{1...12}$ 1913.47 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	87.75	78.01	83.51	77.04	77.08	71.15	70.5	74.38	73.31	79.78	81.61	86.38	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	15.08	13.39	10.89	8.25	6.16	5.2	5.62	7.31	9.81	12.46	14.54	15.5	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	169.15	170.9	166.48	157.06	145.18	134.01	126.54	124.79	129.21	138.63	150.51	161.69	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	(71)
Water heating gains (Table 5)													
(72)m=	117.94	116.09	112.24	107	103.61	98.82	94.76	99.97	101.82	107.23	113.35	116.1	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	354.25	352.47	341.7	324.4	307.03	290.12	279.01	284.15	292.92	310.4	330.49	345.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)

East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)

South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	104.69	185.82	269.59	352.36	406.05	406.68	390.7	351.05	298.82	209.94	126.87	88.58	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	458.95	538.29	611.29	676.76	713.08	696.8	669.71	635.2	591.74	520.35	457.36	433.95	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.88	0.74	0.56	0.4	0.44	0.68	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.24	20.49	20.75	20.92	20.99	21	21	20.96	20.73	20.33	20.01	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.85	0.68	0.48	0.32	0.35	0.6	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.8	19.06	19.41	19.77	19.97	20.03	20.04	20.04	20.01	19.75	19.19	18.73	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.43	19.65	19.95	20.26	20.45	20.51	20.52	20.52	20.49	20.24	19.76	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.43	19.65	19.95	20.26	20.45	20.51	20.52	20.52	20.49	20.24	19.76	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.94	0.86	0.71	0.52	0.36	0.4	0.64	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	453.82	524.88	575.31	580.92	505.01	359.63	241.42	253.26	378.58	465.35	446.45	430.23	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	934.92	911.45	831.33	702.07	540.51	365.07	242.06	254.36	394.65	595.62	782.58	937.36	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	357.94	259.78	190.48	87.23	26.41	0	0	0	0	96.92	242.01	377.31	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1638.09 (98)

Space heating requirement in kWh/m²/year 28 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1638.09	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1719.99	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1913.47	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2009.15	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	37.29	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		37.85	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	37.85	(331)
Energy for lighting (calculated in Appendix L)		266.31	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	866.12	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	19.35	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	885.48	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				885.48	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	19.65	(378)

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CO2 associated with electricity for lighting	(332))) x	0.52	=	138.22	(379)
Total CO2, kg/year	sum of (376)…(382) =			1043.34	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			17.83	(384)
EI rating (section 14)				86.49	(385)

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TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-11-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	58.5	(1a) x	2.4	(2a) =	140.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	58.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	140.4	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.39	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

TER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x 1 =	2.1			(26)
Windows Type 1			2.68	x1/[1/(1.4)+ 0.04] =	3.55			(27)
Windows Type 2			2.68	x1/[1/(1.4)+ 0.04] =	3.55			(27)
Windows Type 3			4.47	x1/[1/(1.4)+ 0.04] =	5.93			(27)
Windows Type 4			2.68	x1/[1/(1.4)+ 0.04] =	3.55			(27)
Walls Type1	40.78	12.51	28.27	x 0.18 =	5.09			(29)
Walls Type2	29.77	2.1	27.67	x 0.18 =	4.98			(29)
Total area of elements, m²			70.55					(31)
Party wall			11.01	x 0 =	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.75 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.41 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 37.16 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	27.36	27.19	27.03	26.29	26.15	25.49	25.49	25.37	25.74	26.15	26.43	26.73	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.52	64.36	64.2	63.45	63.31	62.66	62.66	62.54	62.91	63.31	63.59	63.89

Average = Sum(39)$_{1\ldots12}$ /12= 63.45 (39)

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Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	1.1	1.1	1.1	1.08	1.08	1.07	1.07	1.07	1.08	1.08	1.09	1.09

Average = Sum(40)$_{1…12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 1.94 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 80.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	88.27	85.06	81.85	78.64	75.43	72.22	72.22	75.43	78.64	81.85	85.06	88.27

Total = Sum(44)$_{1…12}$ = 962.99 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	130.91	114.49	118.15	103	98.83	85.29	79.03	90.69	91.77	106.95	116.75	126.78

Total = Sum(45)$_{1…12}$ = 1262.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	19.64	17.17	17.72	15.45	14.83	12.79	11.85	13.6	13.77	16.04	17.51	19.02	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.39 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) — 0.75 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	177.5	156.58	164.74	148.1	145.43	130.38	125.63	137.28	136.86	153.55	161.84	173.37	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	177.5	156.58	164.74	148.1	145.43	130.38	125.63	137.28	136.86	153.55	161.84	173.37	

Output from water heater (annual) 1…12 | 1811.25 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	80.8	71.74	76.56	70.32	70.14	64.43	63.55	67.43	66.59	72.84	74.89	79.43	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	15.1	13.42	10.91	8.26	6.17	5.21	5.63	7.32	9.83	12.48	14.56	15.52	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	169.15	170.9	166.48	157.06	145.18	134.01	126.54	124.79	129.21	138.63	150.51	161.69	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	(71)

Water heating gains (Table 5)

(72)m=	108.61	106.75	102.9	97.67	94.27	89.49	85.42	90.63	92.48	97.9	104.02	106.76	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	347.94	346.16	335.38	318.08	300.71	283.79	272.68	277.82	286.6	304.09	324.18	339.05	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.68	x	19.64	x	0.63	x	0.7	=	16.09	(76)
East	0.9x	1	x	2.68	x	19.64	x	0.63	x	0.7	=	16.09	(76)
East	0.9x	1	x	2.68	x	19.64	x	0.63	x	0.7	=	16.09	(76)
East	0.9x	1	x	2.68	x	38.42	x	0.63	x	0.7	=	31.47	(76)
East	0.9x	1	x	2.68	x	38.42	x	0.63	x	0.7	=	31.47	(76)

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East	0.9x	1	x	2.68	x	38.42	x	0.63	x	0.7	=	31.47	(76)
East	0.9x	1	x	2.68	x	63.27	x	0.63	x	0.7	=	51.82	(76)
East	0.9x	1	x	2.68	x	63.27	x	0.63	x	0.7	=	51.82	(76)
East	0.9x	1	x	2.68	x	63.27	x	0.63	x	0.7	=	51.82	(76)
East	0.9x	1	x	2.68	x	92.28	x	0.63	x	0.7	=	75.58	(76)
East	0.9x	1	x	2.68	x	92.28	x	0.63	x	0.7	=	75.58	(76)
East	0.9x	1	x	2.68	x	92.28	x	0.63	x	0.7	=	75.58	(76)
East	0.9x	1	x	2.68	x	113.09	x	0.63	x	0.7	=	92.63	(76)
East	0.9x	1	x	2.68	x	113.09	x	0.63	x	0.7	=	92.63	(76)
East	0.9x	1	x	2.68	x	113.09	x	0.63	x	0.7	=	92.63	(76)
East	0.9x	1	x	2.68	x	115.77	x	0.63	x	0.7	=	94.82	(76)
East	0.9x	1	x	2.68	x	115.77	x	0.63	x	0.7	=	94.82	(76)
East	0.9x	1	x	2.68	x	115.77	x	0.63	x	0.7	=	94.82	(76)
East	0.9x	1	x	2.68	x	110.22	x	0.63	x	0.7	=	90.27	(76)
East	0.9x	1	x	2.68	x	110.22	x	0.63	x	0.7	=	90.27	(76)
East	0.9x	1	x	2.68	x	110.22	x	0.63	x	0.7	=	90.27	(76)
East	0.9x	1	x	2.68	x	94.68	x	0.63	x	0.7	=	77.54	(76)
East	0.9x	1	x	2.68	x	94.68	x	0.63	x	0.7	=	77.54	(76)
East	0.9x	1	x	2.68	x	94.68	x	0.63	x	0.7	=	77.54	(76)
East	0.9x	1	x	2.68	x	73.59	x	0.63	x	0.7	=	60.27	(76)
East	0.9x	1	x	2.68	x	73.59	x	0.63	x	0.7	=	60.27	(76)
East	0.9x	1	x	2.68	x	73.59	x	0.63	x	0.7	=	60.27	(76)
East	0.9x	1	x	2.68	x	45.59	x	0.63	x	0.7	=	37.34	(76)
East	0.9x	1	x	2.68	x	45.59	x	0.63	x	0.7	=	37.34	(76)
East	0.9x	1	x	2.68	x	45.59	x	0.63	x	0.7	=	37.34	(76)
East	0.9x	1	x	2.68	x	24.49	x	0.63	x	0.7	=	20.06	(76)
East	0.9x	1	x	2.68	x	24.49	x	0.63	x	0.7	=	20.06	(76)
East	0.9x	1	x	2.68	x	24.49	x	0.63	x	0.7	=	20.06	(76)
East	0.9x	1	x	2.68	x	16.15	x	0.63	x	0.7	=	13.23	(76)
East	0.9x	1	x	2.68	x	16.15	x	0.63	x	0.7	=	13.23	(76)
East	0.9x	1	x	2.68	x	16.15	x	0.63	x	0.7	=	13.23	(76)
South	0.9x	0.77	x	4.47	x	46.75	x	0.63	x	0.7	=	63.87	(78)
South	0.9x	0.77	x	4.47	x	76.57	x	0.63	x	0.7	=	104.6	(78)
South	0.9x	0.77	x	4.47	x	97.53	x	0.63	x	0.7	=	133.24	(78)
South	0.9x	0.77	x	4.47	x	110.23	x	0.63	x	0.7	=	150.59	(78)
South	0.9x	0.77	x	4.47	x	114.87	x	0.63	x	0.7	=	156.92	(78)
South	0.9x	0.77	x	4.47	x	110.55	x	0.63	x	0.7	=	151.02	(78)
South	0.9x	0.77	x	4.47	x	108.01	x	0.63	x	0.7	=	147.55	(78)
South	0.9x	0.77	x	4.47	x	104.89	x	0.63	x	0.7	=	143.3	(78)
South	0.9x	0.77	x	4.47	x	101.89	x	0.63	x	0.7	=	139.18	(78)
South	0.9x	0.77	x	4.47	x	82.59	x	0.63	x	0.7	=	112.82	(78)

South	0.9x	0.77	x	4.47	x	55.42	x	0.63	x	0.7	=	75.7	(78)
South	0.9x	0.77	x	4.47	x	40.4	x	0.63	x	0.7	=	55.19	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	112.13	199	288.71	377.33	434.81	435.48	418.37	375.93	320	224.84	135.88	94.87	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	460.07	545.16	624.09	695.41	735.52	719.27	691.05	653.75	606.61	528.92	460.05	433.93	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.88	0.73	0.55	0.4	0.44	0.68	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.19	20.46	20.75	20.92	20.99	21	21	20.96	20.72	20.3	19.96	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20	20	20.01	20.02	20.02	20.02	20.03	20.02	20.02	20.01	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.85	0.68	0.47	0.31	0.35	0.6	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.68	18.96	19.34	19.74	19.95	20.02	20.02	20.02	19.99	19.71	19.13	18.63	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.34	19.57	19.9	20.24	20.43	20.5	20.51	20.51	20.48	20.22	19.71	19.3	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.34	19.57	19.9	20.24	20.43	20.5	20.51	20.51	20.48	20.22	19.71	19.3	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.94	0.85	0.7	0.51	0.35	0.39	0.63	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	455.01	531.53	586.94	594.2	516.39	364.49	244.41	255.99	384.84	472.58	449.18	430.26	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	970.14	944.41	860.2	719.56	552.92	369.78	245.04	257.07	401.2	608.74	802.19	964.41	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	383.26	277.45	203.31	90.26	27.18	0	0	0	0	101.3	254.17	397.4	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1734.33 | (98)

Space heating requirement in kWh/m²/year | 29.65 | (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system | 0 | (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	383.26	277.45	203.31	90.26	27.18	0	0	0	0	101.3	254.17	397.4		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	409.9	296.74	217.44	96.53	29.07	0	0	0	0	108.34	271.84	425.03		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1854.9	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	177.5	156.58	164.74	148.1	145.43	130.38	125.63	137.28	136.86	153.55	161.84	173.37		
Efficiency of water heater													79.8	(216)
(217)m=	86.82	86.32	85.38	83.54	81.31	79.8	79.8	79.8	79.8	83.74	86.01	86.96		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	204.46	181.38	192.96	177.27	178.85	163.38	157.42	172.03	171.51	183.37	188.15	199.37		
Total = Sum(219a)$_{1...12}$ =													2170.17	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1854.9	
Water heating fuel used			2170.17	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			266.74	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	400.66	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	468.76	(264)
Space and water heating	(261) + (262) + (263) + (264) =			869.42	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	138.44	(268)

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Total CO2, kg/year	sum of (265)…(271) =	1046.78	(272)
TER =		17.89	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.8

Property Address: b2-11-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	49.58	(1a) x	2.4	(2a) =	118.99	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.58	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	118.99	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			6.8	x1/[1/(1.2)+ 0.04]		=	7.79			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	33.04	13.24	19.8	x	0.18	=	3.56			(29)
Walls Type2	23.89	2.1	21.79	x	0.18	=	3.92			(29)
Total area of elements, m²			56.93							(31)
Party wall			15.1	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.42 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 34.59 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	

Average = Sum(39)$_{1…12}$ /12= 54.22 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09

Average = Sum(40)$_{1…12}$ /12= 1.09 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.68 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	81.45	78.49	75.53	72.57	69.6	66.64	66.64	69.6	72.57	75.53	78.49	81.45	
											Total = Sum(44)$_{1…12}$ =	888.56	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	120.79	105.64	109.01	95.04	91.19	78.69	72.92	83.68	84.68	98.68	107.72	116.98	
											Total = Sum(45)$_{1…12}$ =	1165.04	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.12	15.85	16.35	14.26	13.68	11.8	10.94	12.55	12.7	14.8	16.16	17.55	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	176.07	155.57	164.29	148.54	146.47	132.19	128.2	138.96	138.17	153.96	161.21	172.25	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	176.07	155.57	164.29	148.54	146.47	132.19	128.2	138.96	138.17	153.96	161.21	172.25

Output from water heater (annual)$_{1...12}$ 1815.88 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.38	75.07	80.47	74.4	74.54	68.96	68.47	72.04	70.95	77.03	78.61	83.12	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.03	11.57	9.41	7.12	5.33	4.5	4.86	6.32	8.48	10.76	12.56	13.39	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	146.14	147.66	143.84	135.7	125.43	115.78	109.33	107.82	111.64	119.77	130.04	139.69	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	(71)

Water heating gains (Table 5)

(72)m=	113.42	111.71	108.16	103.33	100.19	95.78	92.03	96.83	98.54	103.54	109.18	111.72	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	320.76	319.11	309.57	294.32	279.12	264.22	254.38	259.13	266.82	282.24	299.95	312.97	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)

South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	6.8	x	19.64	x	0.5	x	0.8	=	37.02	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	6.8	x	38.42	x	0.5	x	0.8	=	72.42	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	6.8	x	63.27	x	0.5	x	0.8	=	119.27	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	6.8	x	92.28	x	0.5	x	0.8	=	173.94	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	6.8	x	113.09	x	0.5	x	0.8	=	213.18	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	6.8	x	115.77	x	0.5	x	0.8	=	218.22	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	6.8	x	110.22	x	0.5	x	0.8	=	207.76	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	6.8	x	94.68	x	0.5	x	0.8	=	178.46	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	6.8	x	73.59	x	0.5	x	0.8	=	138.71	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	6.8	x	45.59	x	0.5	x	0.8	=	85.93	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	6.8	x	24.49	x	0.5	x	0.8	=	46.16	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)

West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	6.8	x	16.15	x	0.5	x	0.8	=	30.44	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	85.91	160.47	249.7	347.84	415.97	422.23	403.39	352.68	284.51	186.19	105.65	71.64	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	406.67	479.57	559.27	642.16	695.09	686.45	657.77	611.82	551.34	468.43	405.61	384.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.85	0.68	0.5	0.36	0.41	0.65	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.23	20.51	20.79	20.94	20.99	21	21	20.97	20.73	20.32	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.81	0.62	0.42	0.28	0.32	0.57	0.87	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.75	19.02	19.41	19.78	19.96	20	20.01	20.01	19.98	19.72	19.15	18.67	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.39	19.62	19.96	20.28	20.45	20.5	20.5	20.5	20.48	20.23	19.74	19.33	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.39	19.62	19.96	20.28	20.45	20.5	20.5	20.5	20.48	20.23	19.74	19.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.93	0.82	0.65	0.46	0.32	0.36	0.61	0.88	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	401.33	465.69	519.16	528.15	451.93	316.5	211.19	221.66	333.81	412.87	394.54	380.7	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	818.31	798.33	729.7	617.17	474.41	319.66	211.57	222.37	345.65	522.03	685.13	820.36	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	310.23	223.53	156.64	64.1	16.73	0	0	0	0	81.22	209.23	327.11	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1388.78 (98)

Space heating requirement in kWh/m²/year 28.01 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

DER WorkSheet: New dwelling design stage

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1388.78	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1458.22	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1815.88	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1906.67	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	33.65	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		32.08	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	32.08	(331)
Energy for lighting (calculated in Appendix L)		230.09	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	781.52	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	17.46	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	798.99	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				798.99	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	16.65	(378)

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CO2 associated with electricity for lighting	(332))) x	0.52	=	119.42	(379)
Total CO2, kg/year	sum of (376)…(382) =			935.06	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.86	(384)
EI rating (section 14)				86.75	(385)

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User Details:

Assessor Name: | **Stroma Number:**

Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-11-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	49.58	(1a) x	2.4	(2a) =	118.99	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.58	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	118.99	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.43	x1/[1/(1.4)+ 0.04]		=	1.9			(27)
Windows Type 2			2.15	x1/[1/(1.4)+ 0.04]		=	2.85			(27)
Windows Type 3			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 4			1.43	x1/[1/(1.4)+ 0.04]		=	1.9			(27)
Walls Type1	33.04	10.3	22.74	x	0.18	=	4.09			(29)
Walls Type2	23.89	2.1	21.79	x	0.18	=	3.92			(29)
Total area of elements, m²			56.93							(31)
Party wall			15.1	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 23.77 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.22 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 30.99 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	23.66	23.51	23.35	22.63	22.5	21.87	21.87	21.76	22.11	22.5	22.77	23.06	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	54.66	54.5	54.35	53.63	53.49	52.86	52.86	52.75	53.1	53.49	53.76	54.05	

Average = $Sum(39)_{1…12}$ /12= 53.62 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.1	1.1	1.1	1.08	1.08	1.07	1.07	1.06	1.07	1.08	1.08	1.09

Average = Sum(40)$_{1\ldots12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.68 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	81.45	78.49	75.53	72.57	69.6	66.64	66.64	69.6	72.57	75.53	78.49	81.45	
											Total = Sum(44)$_{1\ldots12}$ =	888.56	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	120.79	105.64	109.01	95.04	91.19	78.69	72.92	83.68	84.68	98.68	107.72	116.98	
											Total = Sum(45)$_{1\ldots12}$ =	1165.04	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.12	15.85	16.35	14.26	13.68	11.8	10.94	12.55	12.7	14.8	16.16	17.55	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	167.38	147.73	155.61	140.13	137.79	123.79	119.52	130.27	129.77	145.28	152.81	163.57	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	167.38	147.73	155.61	140.13	137.79	123.79	119.52	130.27	129.77	145.28	152.81	163.57	

Output from water heater (annual)$_{1...12}$ 1713.66 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.44	68.79	73.52	67.67	67.6	62.24	61.52	65.1	64.23	70.09	71.89	76.17	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.07	11.61	9.44	7.15	5.34	4.51	4.88	6.34	8.51	10.8	12.61	13.44	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	146.14	147.66	143.84	135.7	125.43	115.78	109.33	107.82	111.64	119.77	130.04	139.69	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	(71)

Water heating gains (Table 5)

(72)m=	104.08	102.37	98.82	93.99	90.86	86.44	82.69	87.5	89.21	94.2	99.85	102.38	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	314.47	312.81	303.27	288.01	272.8	257.9	248.07	252.82	260.52	275.94	293.66	306.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	1.43	x	46.75	x	0.63	x	0.7	=	20.43	(78)
South	0.9x	0.77	x	1.43	x	76.57	x	0.63	x	0.7	=	33.46	(78)
South	0.9x	0.77	x	1.43	x	97.53	x	0.63	x	0.7	=	42.62	(78)
South	0.9x	0.77	x	1.43	x	110.23	x	0.63	x	0.7	=	48.18	(78)
South	0.9x	0.77	x	1.43	x	114.87	x	0.63	x	0.7	=	50.2	(78)

South	0.9x	0.77	x	1.43	x	110.55	x	0.63	x	0.7	=	48.31	(78)
South	0.9x	0.77	x	1.43	x	108.01	x	0.63	x	0.7	=	47.2	(78)
South	0.9x	0.77	x	1.43	x	104.89	x	0.63	x	0.7	=	45.84	(78)
South	0.9x	0.77	x	1.43	x	101.89	x	0.63	x	0.7	=	44.53	(78)
South	0.9x	0.77	x	1.43	x	82.59	x	0.63	x	0.7	=	36.09	(78)
South	0.9x	0.77	x	1.43	x	55.42	x	0.63	x	0.7	=	24.22	(78)
South	0.9x	0.77	x	1.43	x	40.4	x	0.63	x	0.7	=	17.66	(78)
West	0.9x	0.77	x	1.43	x	19.64	x	0.63	x	0.7	=	8.58	(80)
West	0.9x	0.77	x	2.15	x	19.64	x	0.63	x	0.7	=	12.9	(80)
West	0.9x	0.77	x	5.29	x	19.64	x	0.63	x	0.7	=	31.75	(80)
West	0.9x	0.77	x	1.43	x	38.42	x	0.63	x	0.7	=	16.79	(80)
West	0.9x	0.77	x	2.15	x	38.42	x	0.63	x	0.7	=	25.24	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.63	x	0.7	=	62.11	(80)
West	0.9x	0.77	x	1.43	x	63.27	x	0.63	x	0.7	=	27.65	(80)
West	0.9x	0.77	x	2.15	x	63.27	x	0.63	x	0.7	=	41.57	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.63	x	0.7	=	102.29	(80)
West	0.9x	0.77	x	1.43	x	92.28	x	0.63	x	0.7	=	40.33	(80)
West	0.9x	0.77	x	2.15	x	92.28	x	0.63	x	0.7	=	60.63	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.63	x	0.7	=	149.19	(80)
West	0.9x	0.77	x	1.43	x	113.09	x	0.63	x	0.7	=	49.42	(80)
West	0.9x	0.77	x	2.15	x	113.09	x	0.63	x	0.7	=	74.31	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.63	x	0.7	=	182.84	(80)
West	0.9x	0.77	x	1.43	x	115.77	x	0.63	x	0.7	=	50.59	(80)
West	0.9x	0.77	x	2.15	x	115.77	x	0.63	x	0.7	=	76.07	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.63	x	0.7	=	187.17	(80)
West	0.9x	0.77	x	1.43	x	110.22	x	0.63	x	0.7	=	48.17	(80)
West	0.9x	0.77	x	2.15	x	110.22	x	0.63	x	0.7	=	72.42	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.63	x	0.7	=	178.19	(80)
West	0.9x	0.77	x	1.43	x	94.68	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	2.15	x	94.68	x	0.63	x	0.7	=	62.21	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.63	x	0.7	=	153.06	(80)
West	0.9x	0.77	x	1.43	x	73.59	x	0.63	x	0.7	=	32.16	(80)
West	0.9x	0.77	x	2.15	x	73.59	x	0.63	x	0.7	=	48.35	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.63	x	0.7	=	118.97	(80)
West	0.9x	0.77	x	1.43	x	45.59	x	0.63	x	0.7	=	19.92	(80)
West	0.9x	0.77	x	2.15	x	45.59	x	0.63	x	0.7	=	29.96	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.63	x	0.7	=	73.7	(80)
West	0.9x	0.77	x	1.43	x	24.49	x	0.63	x	0.7	=	10.7	(80)
West	0.9x	0.77	x	2.15	x	24.49	x	0.63	x	0.7	=	16.09	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.63	x	0.7	=	39.59	(80)
West	0.9x	0.77	x	1.43	x	16.15	x	0.63	x	0.7	=	7.06	(80)

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West	0.9x	0.77	x	2.15	x	16.15	x	0.63	x	0.7	=	10.61	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.63	x	0.7	=	26.11	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	73.67	137.61	214.14	298.33	356.77	362.14	345.98	302.49	244.01	159.67	90.6	61.44	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	388.14	450.42	517.42	586.34	629.57	620.04	594.05	555.31	504.53	435.62	384.27	368.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.88	0.73	0.54	0.39	0.43	0.68	0.92	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.17	20.44	20.75	20.93	20.99	21	21	20.96	20.71	20.29	19.96	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20	20	20.02	20.02	20.03	20.03	20.03	20.02	20.02	20.01	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.85	0.67	0.46	0.3	0.34	0.6	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.67	18.93	19.32	19.74	19.95	20.02	20.03	20.03	20	19.7	19.12	18.64	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.33	19.55	19.88	20.24	20.44	20.5	20.51	20.51	20.48	20.2	19.71	19.3	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.33	19.55	19.88	20.24	20.44	20.5	20.51	20.51	20.48	20.2	19.71	19.3	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.94	0.86	0.7	0.5	0.35	0.39	0.64	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	383.95	440.2	488.74	501.76	438.02	308.13	206.37	216.08	324.18	392.73	375.66	365	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	821.66	798.51	727.19	608.19	467.45	312.14	206.86	216.95	338.69	513.61	677.8	816.13	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	325.66	240.78	177.41	76.63	21.89	0	0	0	0	89.93	217.55	335.65	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 1485.5 (98)

Space heating requirement in kWh/m²/year 29.96 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	325.66	240.78	177.41	76.63	21.89	0	0	0	0	89.93	217.55	335.65		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	348.3	257.52	189.74	81.96	23.42	0	0	0	0	96.19	232.67	358.98		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1588.77	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)
Water heating														
Output from water heater (calculated above)	167.38	147.73	155.61	140.13	137.79	123.79	119.52	130.27	129.77	145.28	152.81	163.57		
Efficiency of water heater													79.8	(216)
(217)m=	86.56	86.11	85.16	83.28	81.11	79.8	79.8	79.8	79.8	83.58	85.76	86.69		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	193.37	171.56	182.72	168.27	169.87	155.12	149.77	163.25	162.62	173.82	178.2	188.68		
Total = Sum(219a)$_{1...12}$ =													2057.25	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1588.77	
Water heating fuel used			2057.25	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			230.91	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	343.17	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	444.37	(264)
Space and water heating	(261) + (262) + (263) + (264) =				787.54	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	119.84	(268)

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Total CO2, kg/year	sum of (265)…(271) =	946.31	(272)
TER =		19.09	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b2-12-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.98	(1a) x	2.4	(2a) =	172.75	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.98	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	172.75	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 5			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	41.71	17.94	23.77	x	0.18	=	4.28			(29)
Walls Type2	11.24	2.1	9.14	x	0.18	=	1.65			(29)
Roof	34.4	0	34.4	x	0.11	=	3.78			(30)
Total area of elements, m²			87.35							(31)
Party wall			43.65	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	32.77	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		16.47	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	49.24	(37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	77.75	77.75	77.75	77.75	77.75	77.75	77.75	77.75	77.75	77.75	77.75	77.75

Average = Sum(39)$_{1...12}$ /12= 77.75 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08

Average = Sum(40)$_{1...12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.29 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.66 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.53	93.98	90.44	86.89	83.34	79.8	79.8	83.34	86.89	90.44	93.98	97.53

Total = Sum(44)$_{1...12}$ = 1063.97 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.63	126.5	130.54	113.8	109.2	94.23	87.32	100.2	101.39	118.17	128.99	140.07

Total = Sum(45)$_{1...12}$ = 1395.03 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.7	18.97	19.58	17.07	16.38	14.13	13.1	15.03	15.21	17.72	19.35	21.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.91	176.43	185.81	167.3	164.47	147.72	142.59	155.47	154.89	173.44	182.48	195.35	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.91	176.43	185.81	167.3	164.47	147.72	142.59	155.47	154.89	173.44	182.48	195.35

Output from water heater (annual)$_{1...12}$ | 2045.87 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.31	82	87.62	80.63	80.53	74.13	73.25	77.54	76.51	83.51	85.68	90.8	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18	15.98	13	9.84	7.36	6.21	6.71	8.72	11.71	14.87	17.35	18.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	201.87	203.97	198.69	187.45	173.27	159.93	151.03	148.93	154.21	165.45	179.63	192.97	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	(71)

Water heating gains (Table 5)

(72)m=	124.08	122.03	117.77	111.99	108.24	102.95	98.46	104.22	106.26	112.25	119	122.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	401.34	399.38	386.86	366.68	346.26	326.49	313.59	319.27	329.58	349.96	373.39	390.9	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
East	0.9x	1	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(76)
East	0.9x	1	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(76)
East	0.9x	1	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(76)
East	0.9x	1	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(76)
East	0.9x	1	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(76)
East	0.9x	1	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(76)
East	0.9x	1	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(76)
East	0.9x	1	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(76)
East	0.9x	1	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(76)
East	0.9x	1	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(76)
East	0.9x	1	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(76)
East	0.9x	1	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	66.09	127.6	213.87	329.81	427.83	450.24	423.48	346.58	253.49	151.67	81.91	54.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	467.43	526.98	600.73	696.49	774.09	776.73	737.08	665.85	583.07	501.63	455.3	445.67	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.81	0.62	0.46	0.53	0.8	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.9	20.04	20.29	20.62	20.87	20.98	21	20.99	20.91	20.57	20.17	19.86	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.76	0.53	0.36	0.42	0.73	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.55	18.75	19.12	19.58	19.9	20	20.02	20.01	19.95	19.53	18.95	18.5	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.09	19.27	19.59	20	20.29	20.39	20.41	20.4	20.33	19.94	19.44	19.04	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.09	19.27	19.59	20	20.29	20.39	20.41	20.4	20.33	19.94	19.44	19.04	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.92	0.77	0.57	0.4	0.46	0.75	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	465.04	521.68	584.98	637.94	598.35	439.32	294.6	308.36	439.81	477.35	450.59	443.87	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1150.01	1117.02	1017.51	862.64	667.79	450.28	296.03	311.37	484.58	726.49	959.09	1153.96	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	509.61	400.07	321.8	161.78	51.66	0	0	0	0	185.36	366.12	528.31	

	Total per year (kWh/year) = Sum(98)1...5,9...12 =	2524.71	(98)
Space heating requirement in kWh/m²/year		35.08	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2524.71	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2650.95	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2045.87	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2148.16	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	47.99	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.58	(330a)

warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =		46.58	(331)
Energy for lighting (calculated in Appendix L)			317.84	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	= 1114.63	(367)
Electrical energy for heat distribution	[(313) x		0.52	= 24.91	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			= 1139.54	(373)
CO2 associated with space heating (secondary)	(309) x		0	= 0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	= 0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1139.54	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	= 24.17	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	= 164.96	(379)
Total CO2, kg/year	sum of (376)…(382) =			1328.67	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.46	(384)
EI rating (section 14)				84.78	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-12-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.98	(1a) x	2.4	(2a) =	172.75	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.98	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	172.75	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

TER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.69	x1/[1/(1.4)+ 0.04]		=	6.22			(27)
Windows Type 2			2.45	x1/[1/(1.4)+ 0.04]		=	3.25			(27)
Windows Type 3			2.45	x1/[1/(1.4)+ 0.04]		=	3.25			(27)
Windows Type 4			4.69	x1/[1/(1.4)+ 0.04]		=	6.22			(27)
Windows Type 5			1.63	x1/[1/(1.4)+ 0.04]		=	2.16			(27)
Walls Type1	41.71	15.91	25.8	x	0.18	=	4.64			(29)
Walls Type2	11.24	2.1	9.14	x	0.18	=	1.65			(29)
Roof	34.4	0	34.4	x	0.13	=	4.47			(30)
Total area of elements, m²			87.35							(31)
Party wall			43.65	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.95 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 17.44 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 51.39 (37)

TER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.51	34.28	34.05	32.98	32.78	31.84	31.84	31.67	32.2	32.78	33.18	33.61	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	85.91	85.67	85.45	84.37	84.17	83.23	83.23	83.06	83.59	84.17	84.58	85	

Average = Sum(39)$_{1…12}$ /12= 84.37 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.19	1.19	1.19	1.17	1.17	1.16	1.16	1.15	1.16	1.17	1.17	1.18	

Average = Sum(40)$_{1…12}$ /12= 1.17 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.29 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.66 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	97.53	93.98	90.44	86.89	83.34	79.8	79.8	83.34	86.89	90.44	93.98	97.53	

Total = Sum(44)$_{1…12}$ = 1063.97 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.63	126.5	130.54	113.8	109.2	94.23	87.32	100.2	101.39	118.17	128.99	140.07	

Total = Sum(45)$_{1…12}$ = 1395.03 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.7	18.97	19.58	17.07	16.38	14.13	13.1	15.03	15.21	17.72	19.35	21.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.23	168.58	177.13	158.9	155.79	139.32	133.91	146.79	146.49	164.76	174.08	186.67	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.23	168.58	177.13	158.9	155.79	139.32	133.91	146.79	146.49	164.76	174.08	186.67

Output from water heater (annual)$_{1...12}$ — 1943.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.37	75.73	80.68	73.91	73.58	67.4	66.31	70.59	69.79	76.57	78.96	83.85	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18	15.99	13	9.84	7.36	6.21	6.71	8.73	11.71	14.87	17.36	18.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	201.87	203.97	198.69	187.45	173.27	159.93	151.03	148.93	154.21	165.45	179.63	192.97	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	(71)

Water heating gains (Table 5)

(72)m=	114.74	112.69	108.44	102.66	98.9	93.62	89.12	94.88	96.93	102.91	109.67	112.7	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	395.01	393.05	380.53	360.35	339.93	320.16	307.26	312.93	323.24	343.63	367.06	384.57	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	4.69	x	10.63	x	0.63	x	0.7	=	15.24	(74)
North	0.9x	0.77	x	2.45	x	10.63	x	0.63	x	0.7	=	7.96	(74)
North	0.9x	0.77	x	2.45	x	10.63	x	0.63	x	0.7	=	7.96	(74)
North	0.9x	0.77	x	1.63	x	10.63	x	0.63	x	0.7	=	5.3	(74)
North	0.9x	0.77	x	4.69	x	20.32	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.45	x	20.32	x	0.63	x	0.7	=	15.22	(74)
North	0.9x	0.77	x	2.45	x	20.32	x	0.63	x	0.7	=	15.22	(74)
North	0.9x	0.77	x	1.63	x	20.32	x	0.63	x	0.7	=	10.12	(74)
North	0.9x	0.77	x	4.69	x	34.53	x	0.63	x	0.7	=	49.49	(74)
North	0.9x	0.77	x	2.45	x	34.53	x	0.63	x	0.7	=	25.85	(74)
North	0.9x	0.77	x	2.45	x	34.53	x	0.63	x	0.7	=	25.85	(74)
North	0.9x	0.77	x	1.63	x	34.53	x	0.63	x	0.7	=	17.2	(74)
North	0.9x	0.77	x	4.69	x	55.46	x	0.63	x	0.7	=	79.5	(74)
North	0.9x	0.77	x	2.45	x	55.46	x	0.63	x	0.7	=	41.53	(74)
North	0.9x	0.77	x	2.45	x	55.46	x	0.63	x	0.7	=	41.53	(74)
North	0.9x	0.77	x	1.63	x	55.46	x	0.63	x	0.7	=	27.63	(74)
North	0.9x	0.77	x	4.69	x	74.72	x	0.63	x	0.7	=	107.09	(74)
North	0.9x	0.77	x	2.45	x	74.72	x	0.63	x	0.7	=	55.94	(74)
North	0.9x	0.77	x	2.45	x	74.72	x	0.63	x	0.7	=	55.94	(74)
North	0.9x	0.77	x	1.63	x	74.72	x	0.63	x	0.7	=	37.22	(74)
North	0.9x	0.77	x	4.69	x	79.99	x	0.63	x	0.7	=	114.65	(74)
North	0.9x	0.77	x	2.45	x	79.99	x	0.63	x	0.7	=	59.89	(74)
North	0.9x	0.77	x	2.45	x	79.99	x	0.63	x	0.7	=	59.89	(74)
North	0.9x	0.77	x	1.63	x	79.99	x	0.63	x	0.7	=	39.84	(74)
North	0.9x	0.77	x	4.69	x	74.68	x	0.63	x	0.7	=	107.04	(74)
North	0.9x	0.77	x	2.45	x	74.68	x	0.63	x	0.7	=	55.91	(74)
North	0.9x	0.77	x	2.45	x	74.68	x	0.63	x	0.7	=	55.91	(74)
North	0.9x	0.77	x	1.63	x	74.68	x	0.63	x	0.7	=	37.2	(74)
North	0.9x	0.77	x	4.69	x	59.25	x	0.63	x	0.7	=	84.92	(74)
North	0.9x	0.77	x	2.45	x	59.25	x	0.63	x	0.7	=	44.36	(74)
North	0.9x	0.77	x	2.45	x	59.25	x	0.63	x	0.7	=	44.36	(74)
North	0.9x	0.77	x	1.63	x	59.25	x	0.63	x	0.7	=	29.51	(74)
North	0.9x	0.77	x	4.69	x	41.52	x	0.63	x	0.7	=	59.51	(74)
North	0.9x	0.77	x	2.45	x	41.52	x	0.63	x	0.7	=	31.09	(74)
North	0.9x	0.77	x	2.45	x	41.52	x	0.63	x	0.7	=	31.09	(74)
North	0.9x	0.77	x	1.63	x	41.52	x	0.63	x	0.7	=	20.68	(74)
North	0.9x	0.77	x	4.69	x	24.19	x	0.63	x	0.7	=	34.67	(74)
North	0.9x	0.77	x	2.45	x	24.19	x	0.63	x	0.7	=	18.11	(74)
North	0.9x	0.77	x	2.45	x	24.19	x	0.63	x	0.7	=	18.11	(74)
North	0.9x	0.77	x	1.63	x	24.19	x	0.63	x	0.7	=	12.05	(74)
North	0.9x	0.77	x	4.69	x	13.12	x	0.63	x	0.7	=	18.8	(74)

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North	0.9x	0.77	x	2.45	x	13.12	x	0.63	x	0.7	=	9.82	(74)
North	0.9x	0.77	x	2.45	x	13.12	x	0.63	x	0.7	=	9.82	(74)
North	0.9x	0.77	x	1.63	x	13.12	x	0.63	x	0.7	=	6.53	(74)
North	0.9x	0.77	x	4.69	x	8.86	x	0.63	x	0.7	=	12.71	(74)
North	0.9x	0.77	x	2.45	x	8.86	x	0.63	x	0.7	=	6.64	(74)
North	0.9x	0.77	x	2.45	x	8.86	x	0.63	x	0.7	=	6.64	(74)
North	0.9x	0.77	x	1.63	x	8.86	x	0.63	x	0.7	=	4.42	(74)
East	0.9x	1	x	4.69	x	19.64	x	0.63	x	0.7	=	28.15	(76)
East	0.9x	1	x	4.69	x	38.42	x	0.63	x	0.7	=	55.07	(76)
East	0.9x	1	x	4.69	x	63.27	x	0.63	x	0.7	=	90.69	(76)
East	0.9x	1	x	4.69	x	92.28	x	0.63	x	0.7	=	132.27	(76)
East	0.9x	1	x	4.69	x	113.09	x	0.63	x	0.7	=	162.1	(76)
East	0.9x	1	x	4.69	x	115.77	x	0.63	x	0.7	=	165.94	(76)
East	0.9x	1	x	4.69	x	110.22	x	0.63	x	0.7	=	157.98	(76)
East	0.9x	1	x	4.69	x	94.68	x	0.63	x	0.7	=	135.7	(76)
East	0.9x	1	x	4.69	x	73.59	x	0.63	x	0.7	=	105.48	(76)
East	0.9x	1	x	4.69	x	45.59	x	0.63	x	0.7	=	65.34	(76)
East	0.9x	1	x	4.69	x	24.49	x	0.63	x	0.7	=	35.1	(76)
East	0.9x	1	x	4.69	x	16.15	x	0.63	x	0.7	=	23.15	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	64.61	124.75	209.09	322.45	418.3	440.2	414.04	338.86	247.84	148.29	80.08	53.55	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	459.63	517.8	589.62	682.8	758.22	760.37	721.3	651.79	571.08	491.92	447.14	438.11	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.95	0.85	0.66	0.5	0.57	0.84	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.74	19.88	20.15	20.52	20.82	20.96	20.99	20.99	20.87	20.48	20.05	19.71	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.93	19.93	19.94	19.94	19.96	19.96	19.96	19.95	19.94	19.94	19.94	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.79	0.57	0.39	0.45	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.25	18.46	18.85	19.38	19.77	19.93	19.95	19.95	19.85	19.35	18.72	18.22	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.84	19.03	19.37	19.83	20.19	20.34	20.37	20.36	20.26	19.8	19.25	18.82	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(93)m=	18.84	19.03	19.37	19.83	20.19	20.34	20.37	20.36	20.26	19.8	19.25	18.82		(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	1	0.99	0.98	0.93	0.81	0.6	0.43	0.5	0.79	0.96	0.99	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	457.41	513.1	576.39	634.78	611.48	459.4	310.87	323.9	449.41	471.67	442.97	436.43		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	1249.4	1210.46	1099.6	922.57	714.37	477.92	313.63	329.31	514.76	774.55	1027.72	1242.73		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	589.24	468.62	389.27	207.21	76.55	0	0	0	0	225.34	421.02	599.88		
									Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =				2977.14	(98)
Space heating requirement in kWh/m²/year													41.36	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	589.24	468.62	389.27	207.21	76.55	0	0	0	0	225.34	421.02	599.88		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	630.2	501.2	416.33	221.61	81.87	0	0	0	0	241.01	450.29	641.59		
									Total (kWh/year) =Sum(211)$_{1...5,10....12}$=				3184.1	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
									Total (kWh/year) =Sum(215)$_{1...5,10....12}$=				0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)														
	191.23	168.58	177.13	158.9	155.79	139.32	133.91	146.79	146.49	164.76	174.08	186.67		
Efficiency of water heater													79.8	(216)
(217)m=	87.62	87.4	86.86	85.52	83.03	79.8	79.8	79.8	79.8	85.65	87.08	87.71		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	218.25	192.89	203.93	185.79	187.62	174.59	167.81	183.95	183.57	192.37	199.9	212.82		
									Total = Sum(219a)$_{1...12}$ =				2303.48	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3184.1

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Water heating fuel used			2303.48	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			317.9	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	687.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	497.55	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1185.32	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	164.99	(268)
Total CO2, kg/year		sum of (265)…(271) =		1389.23	(272)

TER =	19.3	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-12-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	110.51	(1a) x	2.4	(2a) =	265.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	110.51	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	265.22	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.1	x	1.2	=	2.52			(26)
Doors Type 2			2.1	x	1.2	=	2.52			(26)
Windows Type 1			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 2			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 6			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	58.45	20.24	38.21	x	0.18	=	6.88			(29)
Walls Type2	49.58	4.2	45.38	x	0.18	=	8.17			(29)
Roof	21.55	0	21.55	x	0.11	=	2.37			(30)
Total area of elements, m²			129.58							(31)
Party wall			22.08	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	45.63	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	21.46	(36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	67.1	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	43.76	43.76	43.76	43.76	43.76	43.76	43.76	43.76	43.76	43.76	43.76	43.76	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	110.86	110.86	110.86	110.86	110.86	110.86	110.86	110.86	110.86	110.86	110.86	110.86	

Average = Sum(39)$_{1…12}$ /12= 110.86 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	1	1	1	1	1	1	1	1	1	1	1	

Average = Sum(40)$_{1…12}$ /12= 1 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.82 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 101.12 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	111.24	107.19	103.15	99.1	95.06	91.01	91.01	95.06	99.1	103.15	107.19	111.24	

Total = Sum(44)$_{1…12}$ = 1213.49 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	164.96	144.28	148.88	129.8	124.54	107.47	99.59	114.28	115.64	134.77	147.11	159.76	

Total = Sum(45)$_{1…12}$ = 1591.07 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.74	21.64	22.33	19.47	18.68	16.12	14.94	17.14	17.35	20.22	22.07	23.96	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	220.24	194.2	204.16	183.29	179.82	160.96	154.86	169.56	169.14	190.05	200.61	215.03	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	220.24	194.2	204.16	183.29	179.82	160.96	154.86	169.56	169.14	190.05	200.61	215.03	

Output from water heater (annual)$_{1...12}$ — 2241.91 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	99.07	87.91	93.72	85.95	85.63	78.53	77.33	82.22	81.25	89.03	91.71	97.34	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	24.35	21.62	17.59	13.31	9.95	8.4	9.08	11.8	15.84	20.11	23.47	25.02	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	272.29	275.11	267.99	252.83	233.7	215.72	203.7	200.88	208	223.16	242.29	260.27	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	(71)

Water heating gains (Table 5)

(72)m=	133.16	130.82	125.97	119.38	115.1	109.07	103.94	110.51	112.84	119.67	127.38	130.83	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	495.06	492.83	476.82	450.79	424.02	398.45	381.99	388.46	401.95	428.2	458.41	481.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)

East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	144.76	264.2	398.68	540.63	636.78	642.87	615.57	544.21	448.96	302.95	176.83	121.53	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	639.82	757.03	875.5	991.43	1060.79	1041.33	997.56	932.67	850.9	731.16	635.24	602.93	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	1	1	0.98	0.94	0.84	0.65	0.48	0.54	0.8	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.94	20.1	20.35	20.65	20.87	20.98	21	20.99	20.93	20.61	20.21	19.9	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.79	0.57	0.39	0.44	0.73	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.66	18.89	19.25	19.67	19.96	20.06	20.08	20.08	20.02	19.63	19.05	18.6	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.04	19.25	19.58	19.96	20.23	20.34	20.35	20.35	20.29	19.93	19.4	18.99	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.04	19.25	19.58	19.96	20.23	20.34	20.35	20.35	20.29	19.93	19.4	18.99	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.92	0.8	0.6	0.42	0.47	0.75	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	637.81	750.86	854.35	915.22	844.78	619.9	414.39	434.79	634.24	697.1	630.55	601.54	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1634.5	1591.16	1450.14	1226.38	946.15	636.07	416.19	438.15	686.71	1033.79	1363.07	1639.49	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	741.54	564.68	443.27	224.03	75.42	0	0	0	0	250.49	527.42	772.23	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 3599.09 (98)

Space heating requirement in kWh/m²/year 32.57 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers	1	(303a)
Fraction of total space heat from Community boilers (302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system	1.05	(306)

Space heating **kWh/year**

Annual space heating requirement 3599.09

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Space heat from Community boilers	(98) x (304a) x (305) x (306) =	3779.04	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2241.91	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2354.01	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	61.33	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		71.51	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	71.51	(331)
Energy for lighting (calculated in Appendix L)		429.97	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1424.45	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	31.83	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1456.28	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1456.28	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	37.11	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	223.16	(379)
Total CO2, kg/year	sum of (376)…(382) =				1716.55	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				15.53	(384)
EI rating (section 14)					85.21	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-12-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	110.51	(1a) x	2.4	(2a) =	265.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	110.51	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	265.22	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.43	0.42	0.37	0.37	0.32	0.32	0.32	0.34	0.37	0.38	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.1	x	1	=	2.1			(26)
Doors Type 2			2.1	x	1	=	2.1			(26)
Windows Type 1			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 2			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 5			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 6			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	58.45	20.24	38.21	x	0.18	=	6.88			(29)
Walls Type2	49.58	4.2	45.38	x	0.18	=	8.17			(29)
Roof	21.55	0	21.55	x	0.13	=	2.8			(30)
Total area of elements, m²			129.58							(31)
Party wall			22.08	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	48.88	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	23.85	(36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	72.73	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	52.02	51.7	51.38	49.91	49.63	48.35	48.35	48.11	48.84	49.63	50.19	50.77	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	124.75	124.43	124.11	122.64	122.36	121.07	121.07	120.84	121.57	122.36	122.92	123.5	

Average = Sum(39)$_{1…12}$ /12= 122.63 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.13	1.13	1.12	1.11	1.11	1.1	1.1	1.09	1.1	1.11	1.11	1.12	

Average = Sum(40)$_{1…12}$ /12= 1.11 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.82 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 101.12 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	111.24	107.19	103.15	99.1	95.06	91.01	91.01	95.06	99.1	103.15	107.19	111.24	

Total = Sum(44)$_{1…12}$ = 1213.49 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	164.96	144.28	148.88	129.8	124.54	107.47	99.59	114.28	115.64	134.77	147.11	159.76	

Total = Sum(45)$_{1…12}$ = 1591.07 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.74	21.64	22.33	19.47	18.68	16.12	14.94	17.14	17.35	20.22	22.07	23.96	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.56	186.36	195.47	174.89	171.14	152.56	146.18	160.87	160.74	181.37	192.2	206.35	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.56	186.36	195.47	174.89	171.14	152.56	146.18	160.87	160.74	181.37	192.2	206.35	

Output from water heater (annual)1…12 2139.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.13	81.64	86.78	79.23	78.69	71.81	70.39	75.27	74.52	82.09	84.99	90.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	24.73	21.96	17.86	13.52	10.11	8.53	9.22	11.98	16.09	20.42	23.84	25.41	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	272.29	275.11	267.99	252.83	233.7	215.72	203.7	200.88	208	223.16	242.29	260.27	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	(71)

Water heating gains (Table 5)

(72)m=	123.82	121.49	116.64	110.04	105.76	99.73	94.61	101.17	103.51	110.33	118.04	121.5	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	489.1	486.83	470.76	444.67	417.84	392.25	375.8	382.3	395.86	422.18	452.44	475.45	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)

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East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
South	0.9x	0.77	x	4.6	x	46.75	x	0.63	x	0.7	=	65.72	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.63	x	0.7	=	107.64	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.63	x	0.7	=	137.12	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.63	x	0.7	=	154.97	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.63	x	0.7	=	161.49	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.63	x	0.7	=	155.41	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.63	x	0.7	=	151.85	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.63	x	0.7	=	147.46	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.63	x	0.7	=	143.23	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.63	x	0.7	=	116.1	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.63	x	0.7	=	77.91	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.63	x	0.7	=	56.79	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	159.6	291.28	439.55	596.05	702.05	708.77	678.67	599.99	494.97	334.01	194.96	133.99	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	648.71	778.11	910.3	1040.72	1119.88	1101.02	1054.46	982.3	890.83	756.19	647.39	609.44	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	1	1	0.98	0.95	0.84	0.67	0.5	0.55	0.81	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.78	19.95	20.23	20.57	20.84	20.96	20.99	20.99	20.9	20.54	20.09	19.75	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.98	19.98	19.99	19.99	20	20	20.01	20	19.99	19.99	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.79	0.58	0.39	0.44	0.74	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.34	18.6	19	19.5	19.84	19.98	20	20	19.92	19.46	18.81	18.31	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.77	19.01	19.37	19.82	20.14	20.28	20.3	20.3	20.22	19.78	19.19	18.74	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.77	19.01	19.37	19.82	20.14	20.28	20.3	20.3	20.22	19.78	19.19	18.74	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.92	0.8	0.6	0.42	0.47	0.75	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	646.46	771.29	887.62	960.93	898.47	664.02	444.96	465.73	672.5	721.43	642.36	607.89	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1805.35	1755.1	1597.5	1339.16	1032.35	687.27	447.91	471.02	743.66	1123.84	1486.69	1795.59	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	862.21	661.12	528.15	272.33	99.61	0	0	0	0	299.39	607.91	883.65	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4214.37 (98)

Space heating requirement in kWh/m²/year 38.14 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	862.21	661.12	528.15	272.33	99.61	0	0	0	0	299.39	607.91	883.65	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	922.15	707.08	564.87	291.26	106.54	0	0	0	0	320.2	650.17	945.08	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 4507.35 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

211.56	186.36	195.47	174.89	171.14	152.56	146.18	160.87	160.74	181.37	192.2	206.35

Efficiency of water heater 79.8 (216)

(217)m=	88.17	87.91	87.34	85.99	83.43	79.8	79.8	79.8	79.8	86.14	87.68	88.26	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	239.94	212	223.82	203.38	205.13	191.18	183.19	201.6	201.42	210.54	219.22	233.8

Total = Sum(219a)$_{1...12}$ = 2525.21 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		4507.35	
Water heating fuel used		2525.21	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		436.67	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	973.59	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	545.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1519.03	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	226.63	(268)
Total CO2, kg/year			sum of (265)…(271) =		1784.59	(272)

TER = 16.15 (273)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version: Version: 1.0.4.8

Property Address: b2-12-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	49.58	(1a) x	2.4	(2a) =	118.99	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.58	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	118.99	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			6.8	x1/[1/(1.2)+ 0.04]		=	7.79			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	33.04	13.24	19.8	x	0.18	=	3.56			(29)
Walls Type2	23.89	2.1	21.79	x	0.18	=	3.92			(29)
Roof	5.9	0	5.9	x	0.11	=	0.65			(30)
Total area of elements, m²			62.83							(31)
Party wall			15.1	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.82 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.58 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 38.4 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	58.03	58.03	58.03	58.03	58.03	58.03	58.03	58.03	58.03	58.03	58.03	58.03	

Average = $Sum(39)_{1...12}$ /12= 58.03 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	

Average = $Sum(40)_{1...12}$ /12= 1.17 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.68 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	81.45	78.49	75.53	72.57	69.6	66.64	66.64	69.6	72.57	75.53	78.49	81.45	

Total = $Sum(44)_{1...12}$ = 888.56 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	120.79	105.64	109.01	95.04	91.19	78.69	72.92	83.68	84.68	98.68	107.72	116.98	

Total = $Sum(45)_{1...12}$ = 1165.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.12	15.85	16.35	14.26	13.68	11.8	10.94	12.55	12.7	14.8	16.16	17.55	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	176.07	155.57	164.29	148.54	146.47	132.19	128.2	138.96	138.17	153.96	161.21	172.25	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	176.07	155.57	164.29	148.54	146.47	132.19	128.2	138.96	138.17	153.96	161.21	172.25

Output from water heater (annual)$_{1...12}$	1815.88	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.38	75.07	80.47	74.4	74.54	68.96	68.47	72.04	70.95	77.03	78.61	83.12	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.03	11.57	9.41	7.12	5.33	4.5	4.86	6.32	8.48	10.76	12.56	13.39	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	146.14	147.66	143.84	135.7	125.43	115.78	109.33	107.82	111.64	119.77	130.04	139.69	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	(71)

Water heating gains (Table 5)

(72)m=	113.42	111.71	108.16	103.33	100.19	95.78	92.03	96.83	98.54	103.54	109.18	111.72	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	320.76	319.11	309.57	294.32	279.12	264.22	254.38	259.13	266.82	282.24	299.95	312.97	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)

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South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	6.8	x	19.64	x	0.5	x	0.8	=	37.02	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	6.8	x	38.42	x	0.5	x	0.8	=	72.42	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	6.8	x	63.27	x	0.5	x	0.8	=	119.27	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	6.8	x	92.28	x	0.5	x	0.8	=	173.94	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	6.8	x	113.09	x	0.5	x	0.8	=	213.18	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	6.8	x	115.77	x	0.5	x	0.8	=	218.22	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	6.8	x	110.22	x	0.5	x	0.8	=	207.76	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	6.8	x	94.68	x	0.5	x	0.8	=	178.46	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	6.8	x	73.59	x	0.5	x	0.8	=	138.71	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	6.8	x	45.59	x	0.5	x	0.8	=	85.93	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)

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West	0.9x	0.77	x	6.8	x	24.49	x	0.5	x	0.8	=	46.16	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	6.8	x	16.15	x	0.5	x	0.8	=	30.44	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	85.91	160.47	249.7	347.84	415.97	422.23	403.39	352.68	284.51	186.19	105.65	71.64	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	406.67	479.57	559.27	642.16	695.09	686.45	657.77	611.82	551.34	468.43	405.61	384.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.87	0.71	0.53	0.39	0.43	0.68	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.13	20.42	20.73	20.92	20.98	21	21	20.95	20.67	20.23	19.88	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.94	19.94	19.94	19.94	19.94	19.94	19.94	19.94	19.94	19.94	19.94	19.94	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.83	0.65	0.45	0.29	0.34	0.59	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.55	18.82	19.24	19.65	19.87	19.93	19.94	19.94	19.91	19.59	18.98	18.47	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.24	19.48	19.83	20.19	20.39	20.46	20.47	20.47	20.43	20.13	19.6	19.18	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.24	19.48	19.83	20.19	20.39	20.46	20.47	20.47	20.43	20.13	19.6	19.18	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.84	0.68	0.49	0.34	0.38	0.63	0.89	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	401.54	466.65	522.92	539.53	471.31	334.65	223.85	234.8	349.33	418.35	395.27	380.81	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	866.93	845.77	773.29	654.95	504.49	340.01	224.58	236.1	367.31	553.18	725.63	869.12	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	346.25	254.77	186.28	83.1	24.69	0	0	0	0	100.31	237.86	363.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1596.57 | (98)

Space heating requirement in kWh/m²/year | 32.2 | (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1596.57	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1676.4	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1815.88	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1906.67	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	35.83	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		32.08	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	32.08	(331)
Energy for lighting (calculated in Appendix L)		230.09	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	832.2	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	18.6	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	850.79	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				850.79	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	16.65	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	119.42	(379)
Total CO2, kg/year	sum of (376)…(382) =			986.86	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			19.9	(384)
EI rating (section 14)				86.02	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b2-12-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	49.58	(1a) x	2.4	(2a) =	118.99	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.58	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	118.99	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.15	x1/[1/(1.4)+ 0.04]		=	2.85			(27)
Windows Type 2			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 3			1.43	x1/[1/(1.4)+ 0.04]		=	1.9			(27)
Windows Type 4			1.43	x1/[1/(1.4)+ 0.04]		=	1.9			(27)
Walls Type1	33.04	10.3	22.74	x	0.18	=	4.09			(29)
Walls Type2	23.89	2.1	21.79	x	0.18	=	3.92			(29)
Roof	5.9	0	5.9	x	0.13	=	0.77			(30)
Total area of elements, m²			62.83							(31)
Party wall			15.1	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	24.54	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		14.29	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	38.83	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	23.66	23.51	23.35	22.63	22.5	21.87	21.87	21.76	22.11	22.5	22.77	23.06	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	62.49	62.33	62.18	61.46	61.32	60.7	60.7	60.58	60.94	61.32	61.6	61.88	

Average = $Sum(39)_{1...12}$ /12= 61.46 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.26	1.26	1.25	1.24	1.24	1.22	1.22	1.22	1.23	1.24	1.24	1.25	

Average = $Sum(40)_{1...12}$ /12= 1.24 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.68 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	81.45	78.49	75.53	72.57	69.6	66.64	66.64	69.6	72.57	75.53	78.49	81.45	

Total = $Sum(44)_{1...12}$ = 888.56 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	120.79	105.64	109.01	95.04	91.19	78.69	72.92	83.68	84.68	98.68	107.72	116.98	

Total = $Sum(45)_{1...12}$ = 1165.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.12	15.85	16.35	14.26	13.68	11.8	10.94	12.55	12.7	14.8	16.16	17.55	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	167.38	147.73	155.61	140.13	137.79	123.79	119.52	130.27	129.77	145.28	152.81	163.57	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	167.38	147.73	155.61	140.13	137.79	123.79	119.52	130.27	129.77	145.28	152.81	163.57

Output from water heater (annual)$_{1…12}$	1713.66	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.44	68.79	73.52	67.67	67.6	62.24	61.52	65.1	64.23	70.09	71.89	76.17	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	13.07	11.61	9.44	7.15	5.34	4.51	4.88	6.34	8.51	10.8	12.61	13.44	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	146.14	147.66	143.84	135.7	125.43	115.78	109.33	107.82	111.64	119.77	130.04	139.69	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	(71)
Water heating gains (Table 5)													
(72)m=	104.08	102.37	98.82	93.99	90.86	86.44	82.69	87.5	89.21	94.2	99.85	102.38	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	314.47	312.81	303.27	288.01	272.8	257.9	248.07	252.82	260.52	275.94	293.66	306.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	1.43	x	46.75	x	0.63	x	0.7	=	20.43	(78)
South	0.9x	0.77	x	1.43	x	76.57	x	0.63	x	0.7	=	33.46	(78)

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South	0.9x	0.77	x	1.43	x	97.53	x	0.63	x	0.7	=	42.62	(78)
South	0.9x	0.77	x	1.43	x	110.23	x	0.63	x	0.7	=	48.18	(78)
South	0.9x	0.77	x	1.43	x	114.87	x	0.63	x	0.7	=	50.2	(78)
South	0.9x	0.77	x	1.43	x	110.55	x	0.63	x	0.7	=	48.31	(78)
South	0.9x	0.77	x	1.43	x	108.01	x	0.63	x	0.7	=	47.2	(78)
South	0.9x	0.77	x	1.43	x	104.89	x	0.63	x	0.7	=	45.84	(78)
South	0.9x	0.77	x	1.43	x	101.89	x	0.63	x	0.7	=	44.53	(78)
South	0.9x	0.77	x	1.43	x	82.59	x	0.63	x	0.7	=	36.09	(78)
South	0.9x	0.77	x	1.43	x	55.42	x	0.63	x	0.7	=	24.22	(78)
South	0.9x	0.77	x	1.43	x	40.4	x	0.63	x	0.7	=	17.66	(78)
West	0.9x	0.77	x	2.15	x	19.64	x	0.63	x	0.7	=	12.9	(80)
West	0.9x	0.77	x	5.29	x	19.64	x	0.63	x	0.7	=	31.75	(80)
West	0.9x	0.77	x	1.43	x	19.64	x	0.63	x	0.7	=	8.58	(80)
West	0.9x	0.77	x	2.15	x	38.42	x	0.63	x	0.7	=	25.24	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.63	x	0.7	=	62.11	(80)
West	0.9x	0.77	x	1.43	x	38.42	x	0.63	x	0.7	=	16.79	(80)
West	0.9x	0.77	x	2.15	x	63.27	x	0.63	x	0.7	=	41.57	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.63	x	0.7	=	102.29	(80)
West	0.9x	0.77	x	1.43	x	63.27	x	0.63	x	0.7	=	27.65	(80)
West	0.9x	0.77	x	2.15	x	92.28	x	0.63	x	0.7	=	60.63	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.63	x	0.7	=	149.19	(80)
West	0.9x	0.77	x	1.43	x	92.28	x	0.63	x	0.7	=	40.33	(80)
West	0.9x	0.77	x	2.15	x	113.09	x	0.63	x	0.7	=	74.31	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.63	x	0.7	=	182.84	(80)
West	0.9x	0.77	x	1.43	x	113.09	x	0.63	x	0.7	=	49.42	(80)
West	0.9x	0.77	x	2.15	x	115.77	x	0.63	x	0.7	=	76.07	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.63	x	0.7	=	187.17	(80)
West	0.9x	0.77	x	1.43	x	115.77	x	0.63	x	0.7	=	50.59	(80)
West	0.9x	0.77	x	2.15	x	110.22	x	0.63	x	0.7	=	72.42	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.63	x	0.7	=	178.19	(80)
West	0.9x	0.77	x	1.43	x	110.22	x	0.63	x	0.7	=	48.17	(80)
West	0.9x	0.77	x	2.15	x	94.68	x	0.63	x	0.7	=	62.21	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.63	x	0.7	=	153.06	(80)
West	0.9x	0.77	x	1.43	x	94.68	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	2.15	x	73.59	x	0.63	x	0.7	=	48.35	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.63	x	0.7	=	118.97	(80)
West	0.9x	0.77	x	1.43	x	73.59	x	0.63	x	0.7	=	32.16	(80)
West	0.9x	0.77	x	2.15	x	45.59	x	0.63	x	0.7	=	29.96	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.63	x	0.7	=	73.7	(80)
West	0.9x	0.77	x	1.43	x	45.59	x	0.63	x	0.7	=	19.92	(80)
West	0.9x	0.77	x	2.15	x	24.49	x	0.63	x	0.7	=	16.09	(80)

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West	0.9x	0.77	x	5.29	x	24.49	x	0.63	x	0.7	=	39.59	(80)
West	0.9x	0.77	x	1.43	x	24.49	x	0.63	x	0.7	=	10.7	(80)
West	0.9x	0.77	x	2.15	x	16.15	x	0.63	x	0.7	=	10.61	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.63	x	0.7	=	26.11	(80)
West	0.9x	0.77	x	1.43	x	16.15	x	0.63	x	0.7	=	7.06	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	73.67	137.61	214.14	298.33	356.77	362.14	345.98	302.49	244.01	159.67	90.6	61.44	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	388.14	450.42	517.42	586.34	629.57	620.04	594.05	555.31	504.53	435.62	384.27	368.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.91	0.78	0.6	0.44	0.49	0.74	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.78	19.96	20.25	20.61	20.86	20.97	20.99	20.99	20.92	20.58	20.11	19.75	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.87	19.87	19.88	19.89	19.89	19.9	19.9	19.9	19.9	19.89	19.89	19.88	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.88	0.72	0.51	0.34	0.38	0.66	0.92	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.27	18.54	18.96	19.45	19.76	19.88	19.9	19.9	19.84	19.42	18.77	18.23	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.03	19.25	19.61	20.03	20.31	20.43	20.45	20.44	20.38	20	19.44	18.99	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.03	19.25	19.61	20.03	20.31	20.43	20.45	20.44	20.38	20	19.44	18.99	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.88	0.75	0.55	0.39	0.44	0.7	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	384.14	441.24	493.17	517.52	469.77	342.8	231.82	242.28	351.47	400.38	376.55	365.08	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	920.19	894.49	814.98	683.95	527.86	353.58	233.46	245.02	382.44	576.45	760.08	915.25	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	398.82	304.59	239.43	119.83	43.22	0	0	0	0	131	276.14	409.33	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1922.34 (98)

Space heating requirement in kWh/m²/year 38.77 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	398.82	304.59	239.43	119.83	43.22	0	0	0	0	131	276.14	409.33		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	426.55	325.76	256.07	128.16	46.22	0	0	0	0	140.1	295.34	437.78		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2055.98	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	167.38	147.73	155.61	140.13	137.79	123.79	119.52	130.27	129.77	145.28	152.81	163.57		
Efficiency of water heater													79.8	(216)
(217)m=	87.05	86.7	85.96	84.4	82.12	79.8	79.8	79.8	79.8	84.54	86.37	87.16		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	192.29	170.39	181.03	166.04	167.79	155.12	149.77	163.25	162.62	171.85	176.92	187.66		
Total = Sum(219a)$_{1...12}$ =													2044.72	(219)

Annual totals

		kWh/year	kWh/year	
Space heating fuel used, main system 1			2055.98	
Water heating fuel used			2044.72	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			230.91	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	444.09	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	441.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =			885.75	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	119.84	(268)
Total CO2, kg/year		sum of (265)…(271) =			1044.52	(272)

TER =	21.07	(273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-12-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.39	(1a) x	2.4	(2a) =	176.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.39	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		176.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			6.9	x1/[1/(1.2)+ 0.04]		=	7.9			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	40.92	17.94	22.98	x	0.18	=	4.14			(29)
Walls Type2	21.61	2.1	19.51	x	0.18	=	3.51			(29)
Roof	24.37	0	24.37	x	0.11	=	2.68			(30)
Total area of elements, m²			86.9							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	33.39	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		15.93	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	49.32	(37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.38	78.38	78.38	78.38	78.38	78.38	78.38	78.38	78.38	78.38	78.38	78.38	

Average = Sum(39)$_{1...12}$ /12= 78.38 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	

Average = Sum(40)$_{1...12}$ /12= 1.07 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.37	94.8	91.22	87.64	84.07	80.49	80.49	84.07	87.64	91.22	94.8	98.37	

Total = Sum(44)$_{1...12}$ = 1073.18 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.89	127.59	131.67	114.79	110.14	95.04	88.07	101.06	102.27	119.19	130.1	141.28	

Total = Sum(45)$_{1...12}$ = 1407.11 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.88	19.14	19.75	17.22	16.52	14.26	13.21	15.16	15.34	17.88	19.52	21.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.16	177.52	186.94	168.28	165.42	148.54	143.35	156.34	155.77	174.46	183.6	196.56	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.16	177.52	186.94	168.28	165.42	148.54	143.35	156.34	155.77	174.46	183.6	196.56

Output from water heater (annual)$_{1...12}$ — 2057.94 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.73	82.37	88	80.96	80.84	74.4	73.51	77.83	76.8	83.85	86.05	91.2	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.28	16.24	13.21	10	7.47	6.31	6.82	8.86	11.89	15.1	17.63	18.79	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.08	207.2	201.84	190.43	176.01	162.47	153.42	151.29	156.66	168.07	182.48	196.03	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	(71)

Water heating gains (Table 5)

(72)m=	124.64	122.57	118.28	112.45	108.66	103.33	98.8	104.6	106.67	112.7	119.52	122.58	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	405.88	403.9	391.21	370.75	350.03	329.99	316.92	322.64	333.1	353.76	377.51	395.28	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	6.9	x	19.64	x	0.5	x	0.8	=	37.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	6.9	x	38.42	x	0.5	x	0.8	=	73.49	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	6.9	x	63.27	x	0.5	x	0.8	=	121.02	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	6.9	x	92.28	x	0.5	x	0.8	=	176.5	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	6.9	x	113.09	x	0.5	x	0.8	=	216.31	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)

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West	0.9x	0.77	x	6.9	x	115.77	x	0.5	x	0.8	=	221.43	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	6.9	x	110.22	x	0.5	x	0.8	=	210.81	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	6.9	x	94.68	x	0.5	x	0.8	=	181.08	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	6.9	x	73.59	x	0.5	x	0.8	=	140.75	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	6.9	x	45.59	x	0.5	x	0.8	=	87.2	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	6.9	x	24.49	x	0.5	x	0.8	=	46.84	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	6.9	x	16.15	x	0.5	x	0.8	=	30.89	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	83.89	163.37	270.67	402.57	503.68	520.97	493.73	416.61	316.88	193.97	104.38	69.17	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	489.77	567.26	661.89	773.33	853.72	850.96	810.65	739.25	649.98	547.73	481.9	464.45	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.77	0.57	0.42	0.48	0.76	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.09	20.36	20.69	20.91	20.98	21	20.99	20.94	20.62	20.21	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.89	0.71	0.49	0.33	0.38	0.68	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.61	18.84	19.23	19.67	19.94	20.02	20.03	20.02	19.98	19.6	19.01	18.55	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.14	19.34	19.68	20.08	20.33	20.4	20.41	20.41	20.36	20.01	19.49	19.08	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.14	19.34	19.68	20.08	20.33	20.4	20.41	20.41	20.36	20.01	19.49	19.08	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.96	0.89	0.73	0.53	0.37	0.42	0.71	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	486.94	560.07	638.38	688.04	623.68	447.26	298.08	312.64	458.51	513.73	476.04	462.39	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1163.13	1131.87	1033.26	876.26	676.23	454.9	299	314.55	490.83	737.45	970.9	1166.73	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	503.08	384.25	293.79	135.52	39.1	0	0	0	0	166.45	356.29	524.03	

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2402.51	(98)
Space heating requirement in kWh/m²/year		32.74	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2402.51	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2522.63	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2057.94	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2160.84	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	46.83	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.49	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			47.49	(331)
Energy for lighting (calculated in Appendix L)				322.88	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1087.78	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	24.31	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1112.08	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1112.08	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	24.65	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	167.57	(379)
Total CO2, kg/year	sum of (376)…(382) =				1304.3	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17.77	(384)
EI rating (section 14)					85.24	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-12-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.39	(1a) x	2.4	(2a) =	176.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: | 0 | (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) | 0 | (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 0 | (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 2			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 3			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 4			6.25	x1/[1/(1.4)+ 0.04]		=	8.29			(27)
Windows Type 5			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Walls Type1	40.92	16.25	24.67	x	0.18	=	4.44			(29)
Walls Type2	21.61	2.1	19.51	x	0.18	=	3.51			(29)
Roof	24.37	0	24.37	x	0.13	=	3.17			(30)
Total area of elements, m²			86.9							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = | 34.76 | (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = | 0 | (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium | 250 | (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 17.12 | (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = | 51.88 | (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.09	34.86	34.63	33.55	33.35	32.41	32.41	32.24	32.77	33.35	33.76	34.18	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	86.98	86.74	86.51	85.43	85.23	84.29	84.29	84.12	84.66	85.23	85.64	86.07	

Average = Sum(39)$_{1...12}$ /12= 85.43 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.19	1.18	1.18	1.16	1.16	1.15	1.15	1.15	1.15	1.16	1.17	1.17	

Average = Sum(40)$_{1...12}$ /12= 1.16 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	98.37	94.8	91.22	87.64	84.07	80.49	80.49	84.07	87.64	91.22	94.8	98.37	

Total = Sum(44)$_{1...12}$ = 1073.18 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.89	127.59	131.67	114.79	110.14	95.04	88.07	101.06	102.27	119.19	130.1	141.28	

Total = Sum(45)$_{1...12}$ = 1407.11 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.88	19.14	19.75	17.22	16.52	14.26	13.21	15.16	15.34	17.88	19.52	21.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	192.48	169.68	178.26	159.88	156.74	140.14	134.67	147.66	147.36	165.78	175.19	187.88	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	192.48	169.68	178.26	159.88	156.74	140.14	134.67	147.66	147.36	165.78	175.19	187.88

Output from water heater (annual)$_{1…12}$ | 1955.72 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.78	76.09	81.05	74.24	73.9	67.68	66.56	70.88	70.08	76.91	79.33	84.25	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.29	16.24	13.21	10	7.47	6.31	6.82	8.86	11.9	15.1	17.63	18.79	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.08	207.2	201.84	190.43	176.01	162.47	153.42	151.29	156.66	168.07	182.48	196.03	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	(71)

Water heating gains (Table 5)

(72)m=	115.3	113.23	108.94	103.11	99.33	93.99	89.46	95.27	97.33	103.37	110.18	113.24	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	399.55	397.56	384.88	364.42	343.7	323.66	310.59	316.31	326.77	347.43	371.18	388.95	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	2.5	x	10.63	x	0.63	x	0.7	=	8.12	(74)
North	0.9x	0.77	x	2.5	x	10.63	x	0.63	x	0.7	=	8.12	(74)
North	0.9x	0.77	x	2.5	x	20.32	x	0.63	x	0.7	=	15.53	(74)
North	0.9x	0.77	x	2.5	x	20.32	x	0.63	x	0.7	=	15.53	(74)
North	0.9x	0.77	x	2.5	x	34.53	x	0.63	x	0.7	=	26.38	(74)
North	0.9x	0.77	x	2.5	x	34.53	x	0.63	x	0.7	=	26.38	(74)
North	0.9x	0.77	x	2.5	x	55.46	x	0.63	x	0.7	=	42.38	(74)
North	0.9x	0.77	x	2.5	x	55.46	x	0.63	x	0.7	=	42.38	(74)
North	0.9x	0.77	x	2.5	x	74.72	x	0.63	x	0.7	=	57.09	(74)
North	0.9x	0.77	x	2.5	x	74.72	x	0.63	x	0.7	=	57.09	(74)
North	0.9x	0.77	x	2.5	x	79.99	x	0.63	x	0.7	=	61.11	(74)
North	0.9x	0.77	x	2.5	x	79.99	x	0.63	x	0.7	=	61.11	(74)
North	0.9x	0.77	x	2.5	x	74.68	x	0.63	x	0.7	=	57.06	(74)
North	0.9x	0.77	x	2.5	x	74.68	x	0.63	x	0.7	=	57.06	(74)
North	0.9x	0.77	x	2.5	x	59.25	x	0.63	x	0.7	=	45.27	(74)
North	0.9x	0.77	x	2.5	x	59.25	x	0.63	x	0.7	=	45.27	(74)
North	0.9x	0.77	x	2.5	x	41.52	x	0.63	x	0.7	=	31.72	(74)
North	0.9x	0.77	x	2.5	x	41.52	x	0.63	x	0.7	=	31.72	(74)
North	0.9x	0.77	x	2.5	x	24.19	x	0.63	x	0.7	=	18.48	(74)
North	0.9x	0.77	x	2.5	x	24.19	x	0.63	x	0.7	=	18.48	(74)
North	0.9x	0.77	x	2.5	x	13.12	x	0.63	x	0.7	=	10.02	(74)
North	0.9x	0.77	x	2.5	x	13.12	x	0.63	x	0.7	=	10.02	(74)
North	0.9x	0.77	x	2.5	x	8.86	x	0.63	x	0.7	=	6.77	(74)
North	0.9x	0.77	x	2.5	x	8.86	x	0.63	x	0.7	=	6.77	(74)
West	0.9x	0.77	x	2.5	x	19.64	x	0.63	x	0.7	=	15.01	(80)
West	0.9x	0.77	x	2.5	x	19.64	x	0.63	x	0.7	=	15.01	(80)
West	0.9x	0.77	x	6.25	x	19.64	x	0.63	x	0.7	=	37.51	(80)
West	0.9x	0.77	x	2.5	x	38.42	x	0.63	x	0.7	=	29.35	(80)
West	0.9x	0.77	x	2.5	x	38.42	x	0.63	x	0.7	=	29.35	(80)
West	0.9x	0.77	x	6.25	x	38.42	x	0.63	x	0.7	=	73.39	(80)
West	0.9x	0.77	x	2.5	x	63.27	x	0.63	x	0.7	=	48.34	(80)
West	0.9x	0.77	x	2.5	x	63.27	x	0.63	x	0.7	=	48.34	(80)
West	0.9x	0.77	x	6.25	x	63.27	x	0.63	x	0.7	=	120.86	(80)
West	0.9x	0.77	x	2.5	x	92.28	x	0.63	x	0.7	=	70.5	(80)
West	0.9x	0.77	x	2.5	x	92.28	x	0.63	x	0.7	=	70.5	(80)
West	0.9x	0.77	x	6.25	x	92.28	x	0.63	x	0.7	=	176.26	(80)
West	0.9x	0.77	x	2.5	x	113.09	x	0.63	x	0.7	=	86.41	(80)
West	0.9x	0.77	x	2.5	x	113.09	x	0.63	x	0.7	=	86.41	(80)
West	0.9x	0.77	x	6.25	x	113.09	x	0.63	x	0.7	=	216.02	(80)
West	0.9x	0.77	x	2.5	x	115.77	x	0.63	x	0.7	=	88.45	(80)
West	0.9x	0.77	x	2.5	x	115.77	x	0.63	x	0.7	=	88.45	(80)

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West	0.9x	0.77	x	6.25	x	115.77	x	0.63	x	0.7	=	221.13	(80)
West	0.9x	0.77	x	2.5	x	110.22	x	0.63	x	0.7	=	84.21	(80)
West	0.9x	0.77	x	2.5	x	110.22	x	0.63	x	0.7	=	84.21	(80)
West	0.9x	0.77	x	6.25	x	110.22	x	0.63	x	0.7	=	210.53	(80)
West	0.9x	0.77	x	2.5	x	94.68	x	0.63	x	0.7	=	72.34	(80)
West	0.9x	0.77	x	2.5	x	94.68	x	0.63	x	0.7	=	72.34	(80)
West	0.9x	0.77	x	6.25	x	94.68	x	0.63	x	0.7	=	180.84	(80)
West	0.9x	0.77	x	2.5	x	73.59	x	0.63	x	0.7	=	56.22	(80)
West	0.9x	0.77	x	2.5	x	73.59	x	0.63	x	0.7	=	56.22	(80)
West	0.9x	0.77	x	6.25	x	73.59	x	0.63	x	0.7	=	140.56	(80)
West	0.9x	0.77	x	2.5	x	45.59	x	0.63	x	0.7	=	34.83	(80)
West	0.9x	0.77	x	2.5	x	45.59	x	0.63	x	0.7	=	34.83	(80)
West	0.9x	0.77	x	6.25	x	45.59	x	0.63	x	0.7	=	87.08	(80)
West	0.9x	0.77	x	2.5	x	24.49	x	0.63	x	0.7	=	18.71	(80)
West	0.9x	0.77	x	2.5	x	24.49	x	0.63	x	0.7	=	18.71	(80)
West	0.9x	0.77	x	6.25	x	24.49	x	0.63	x	0.7	=	46.78	(80)
West	0.9x	0.77	x	2.5	x	16.15	x	0.63	x	0.7	=	12.34	(80)
West	0.9x	0.77	x	2.5	x	16.15	x	0.63	x	0.7	=	12.34	(80)
West	0.9x	0.77	x	6.25	x	16.15	x	0.63	x	0.7	=	30.85	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	83.77	163.15	270.31	402.03	503	520.26	493.06	416.04	316.45	193.71	104.24	69.08	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	483.32	560.71	655.18	766.45	846.7	843.92	803.64	732.35	643.22	541.13	475.42	458.02	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.8	0.61	0.46	0.52	0.79	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.77	19.93	20.22	20.59	20.86	20.97	20.99	20.99	20.9	20.53	20.08	19.74	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.93	19.94	19.95	19.95	19.96	19.96	19.96	19.96	19.95	19.95	19.94	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.75	0.52	0.35	0.41	0.71	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.3	18.54	18.96	19.48	19.82	19.94	19.96	19.96	19.88	19.42	18.77	18.27	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.88	19.1	19.46	19.93	20.23	20.36	20.37	20.37	20.29	19.87	19.3	18.86	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.88	19.1	19.46	19.93	20.23	20.36	20.37	20.37	20.29	19.87	19.3	18.86	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.76	0.56	0.39	0.45	0.74	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	480.68	554.27	635.08	694.21	646.93	471.93	316.28	330.61	475.08	512.27	470.18	456.08	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1268.48	1231.45	1121.5	941.99	727.43	485.13	318.1	334.12	524.2	789.77	1044.52	1261.33	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	586.12	455.06	361.9	178.4	59.89	0	0	0	0	206.46	413.52	599.11	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2860.46 (98)

Space heating requirement in kWh/m²/year 38.98 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	586.12	455.06	361.9	178.4	59.89	0	0	0	0	206.46	413.52	599.11		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	626.87	486.7	387.05	190.8	64.06	0	0	0	0	220.81	442.27	640.75		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3059.32	(211)
Space heating fuel (secondary), kWh/month														
= {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	192.48	169.68	178.26	159.88	156.74	140.14	134.67	147.66	147.36	165.78	175.19	187.88		
Efficiency of water heater													79.8	(216)
(217)m=	87.6	87.32	86.67	85.11	82.5	79.8	79.8	79.8	79.8	85.4	87.03	87.69		(217)
Fuel for water heating, kWh/month														
(219)m = (64)m x 100 ÷ (217)m														
(219)m=	219.74	194.32	205.69	187.86	189.99	175.61	168.76	185.04	184.67	194.12	201.31	214.25		
Total = Sum(219a)$_{1...12}$ =													2321.35	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3059.32

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Water heating fuel used			2321.35	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			322.93	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	660.81	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	501.41	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1162.22	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	167.6	(268)
Total CO2, kg/year		sum of (265)…(271) =		1368.75	(272)
TER =				18.65	(273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-13-01

Address :	Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	52.79	(1a) x	2.4	(2a) =	126.7	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.79	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	126.7	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 6			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	37.11	16.56	20.55	x	0.18	=	3.7			(29)
Walls Type2	24.51	2.1	22.41	x	0.18	=	4.03			(29)
Roof	52.79	0	52.79	x	0.11	=	5.81			(30)
Total area of elements, m²			114.41							(31)
Party wall			3.53	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.02 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 17.95 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

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Total fabric heat loss	(33) + (36) =	52.98	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.88	73.88	73.88	73.88	73.88	73.88	73.88	73.88	73.88	73.88	73.88	73.88	

Average = $Sum(39)_{1...12}$ /12= 73.88 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	

Average = $Sum(40)_{1...12}$ /12= 1.4 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.77 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 76.29 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	83.92	80.87	77.82	74.77	71.72	68.66	68.66	71.72	74.77	77.82	80.87	83.92	

Total = $Sum(44)_{1...12}$ = 915.53 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	124.46	108.85	112.32	97.93	93.96	81.08	75.13	86.22	87.25	101.68	110.99	120.53	

Total = $Sum(45)_{1...12}$ = 1200.4 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.67	16.33	16.85	14.69	14.09	12.16	11.27	12.93	13.09	15.25	16.65	18.08	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.73	158.78	167.6	151.42	149.24	134.58	130.41	141.5	140.74	156.96	164.48	175.81	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.73	158.78	167.6	151.42	149.24	134.58	130.41	141.5	140.74	156.96	164.48	175.81	

Output from water heater (annual)$_{1...12}$ 1851.24 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.6	76.13	81.57	75.36	75.46	69.75	69.2	72.89	71.8	78.03	79.7	84.3	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.77	12.23	9.95	7.53	5.63	4.75	5.14	6.68	8.96	11.38	13.28	14.15	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	154.47	156.08	152.04	143.44	132.58	122.38	115.56	113.96	118	126.6	137.46	147.66	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	(71)

Water heating gains (Table 5)

(72)m=	115.06	113.3	109.64	104.66	101.43	96.88	93.02	97.97	99.73	104.88	110.69	113.3	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	332.89	331.19	321.21	305.21	289.23	273.6	263.3	268.19	276.28	292.44	311.01	324.7	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)

East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	69.48	134.82	224.48	339.11	431.06	449.3	424.37	353.28	264.19	160.16	86.32	57.42	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	402.37	466.01	545.69	644.32	720.29	722.9	687.67	621.48	540.47	452.6	397.33	382.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.99	0.97	0.92	0.79	0.61	0.46	0.53	0.79	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.58	19.76	20.08	20.48	20.8	20.95	20.99	20.98	20.86	20.43	19.92	19.54	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.76	19.76	19.76	19.76	19.76	19.76	19.76	19.76	19.76	19.76	19.76	19.76	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.89	0.73	0.51	0.34	0.4	0.7	0.93	0.99	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.91	18.17	18.63	19.19	19.59	19.73	19.76	19.76	19.66	19.13	18.41	17.84	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.75	18.97	19.36	19.84	20.19	20.34	20.37	20.37	20.26	19.78	19.16	18.69	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.75	18.97	19.36	19.84	20.19	20.34	20.37	20.37	20.26	19.78	19.16	18.69	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.89	0.75	0.56	0.4	0.46	0.74	0.93	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	398.6	457.78	523.17	573.95	541.53	405.49	275.42	286.97	397.73	422.74	390.45	379.2	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1067.34	1039.21	949.78	808.09	627.51	424.24	278.84	293.18	454.93	678.15	891.36	1070.54	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	497.54	390.72	317.4	168.58	63.97	0	0	0	0	190.03	360.65	514.36	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 2503.24 (98)

Space heating requirement in kWh/m²/year 47.42 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.
Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers 1 (303a)

Fraction of total space heat from Community boilers (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 2503.24

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Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2628.4	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		1851.24	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1943.8	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	45.72	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		34.16	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	34.16	(331)
Energy for lighting (calculated in Appendix L)		243.21	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1061.93	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	23.73	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1085.66	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1085.66	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	17.73	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	126.23	(379)

Total CO2, kg/year	sum of (376)…(382) =	1229.62	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =	23.29	(384)
EI rating (section 14)		83.15	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-13-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	52.79	(1a)	x	2.4	(2a)	=	126.7	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.79	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			126.7	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.85	x1/[1/(1.4)+ 0.04]		=	2.45			(27)
Windows Type 2			1.85	x1/[1/(1.4)+ 0.04]		=	2.45			(27)
Windows Type 3			1.85	x1/[1/(1.4)+ 0.04]		=	2.45			(27)
Windows Type 4			1.85	x1/[1/(1.4)+ 0.04]		=	2.45			(27)
Windows Type 5			1.85	x1/[1/(1.4)+ 0.04]		=	2.45			(27)
Windows Type 6			1.85	x1/[1/(1.4)+ 0.04]		=	2.45			(27)
Walls Type1	37.11	11.1	26.01	x	0.18	=	4.68			(29)
Walls Type2	24.51	2.1	22.41	x	0.18	=	4.03			(29)
Roof	52.79	0	52.79	x	0.13	=	6.86			(30)
Total area of elements, m²			114.41							(31)
Party wall			3.53	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.39 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 19.13 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

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Total fabric heat loss (33) + (36) = 51.53 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	24.99	24.83	24.68	23.94	23.81	23.17	23.17	23.05	23.42	23.81	24.08	24.37	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.52	76.36	76.2	75.47	75.34	74.7	74.7	74.58	74.94	75.34	75.61	75.9	

Average = Sum(39)$_{1…12}$ /12= 75.47 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.45	1.45	1.44	1.43	1.43	1.42	1.42	1.41	1.42	1.43	1.43	1.44	

Average = Sum(40)$_{1…12}$ /12= 1.43 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.77 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 76.29 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	83.92	80.87	77.82	74.77	71.72	68.66	68.66	71.72	74.77	77.82	80.87	83.92	

Total = Sum(44)$_{1…12}$ = 915.53 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	124.46	108.85	112.32	97.93	93.96	81.08	75.13	86.22	87.25	101.68	110.99	120.53	

Total = Sum(45)$_{1…12}$ = 1200.4 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.67	16.33	16.85	14.69	14.09	12.16	11.27	12.93	13.09	15.25	16.65	18.08	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	171.05	150.94	158.92	143.02	140.56	126.17	121.73	132.81	132.34	148.27	156.08	167.12	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	171.05	150.94	158.92	143.02	140.56	126.17	121.73	132.81	132.34	148.27	156.08	167.12	

Output from water heater (annual)$_{1...12}$ 1749.02 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	78.66	69.86	74.62	68.63	68.52	63.03	62.26	65.94	65.08	71.08	72.98	77.35	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.81	12.26	9.97	7.55	5.64	4.77	5.15	6.69	8.98	11.41	13.31	14.19	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	154.47	156.08	152.04	143.44	132.58	122.38	115.56	113.96	118	126.6	137.46	147.66	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	(71)

Water heating gains (Table 5)

(72)m=	105.72	103.96	100.3	95.32	92.09	87.55	83.68	88.63	90.39	95.54	101.36	103.97	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	326.59	324.89	314.9	298.9	282.91	267.28	256.98	261.87	269.96	286.14	304.71	318.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.85	x	10.63	x	0.63	x	0.7	=	6.01	(74)
North	0.9x	0.77	x	1.85	x	10.63	x	0.63	x	0.7	=	6.01	(74)
North	0.9x	0.77	x	1.85	x	10.63	x	0.63	x	0.7	=	6.01	(74)
North	0.9x	0.77	x	1.85	x	20.32	x	0.63	x	0.7	=	11.49	(74)
North	0.9x	0.77	x	1.85	x	20.32	x	0.63	x	0.7	=	11.49	(74)
North	0.9x	0.77	x	1.85	x	20.32	x	0.63	x	0.7	=	11.49	(74)
North	0.9x	0.77	x	1.85	x	34.53	x	0.63	x	0.7	=	19.52	(74)
North	0.9x	0.77	x	1.85	x	34.53	x	0.63	x	0.7	=	19.52	(74)
North	0.9x	0.77	x	1.85	x	34.53	x	0.63	x	0.7	=	19.52	(74)
North	0.9x	0.77	x	1.85	x	55.46	x	0.63	x	0.7	=	31.36	(74)
North	0.9x	0.77	x	1.85	x	55.46	x	0.63	x	0.7	=	31.36	(74)
North	0.9x	0.77	x	1.85	x	55.46	x	0.63	x	0.7	=	31.36	(74)
North	0.9x	0.77	x	1.85	x	74.72	x	0.63	x	0.7	=	42.24	(74)
North	0.9x	0.77	x	1.85	x	74.72	x	0.63	x	0.7	=	42.24	(74)
North	0.9x	0.77	x	1.85	x	74.72	x	0.63	x	0.7	=	42.24	(74)
North	0.9x	0.77	x	1.85	x	79.99	x	0.63	x	0.7	=	45.22	(74)
North	0.9x	0.77	x	1.85	x	79.99	x	0.63	x	0.7	=	45.22	(74)
North	0.9x	0.77	x	1.85	x	79.99	x	0.63	x	0.7	=	45.22	(74)
North	0.9x	0.77	x	1.85	x	74.68	x	0.63	x	0.7	=	42.22	(74)
North	0.9x	0.77	x	1.85	x	74.68	x	0.63	x	0.7	=	42.22	(74)
North	0.9x	0.77	x	1.85	x	74.68	x	0.63	x	0.7	=	42.22	(74)
North	0.9x	0.77	x	1.85	x	59.25	x	0.63	x	0.7	=	33.5	(74)
North	0.9x	0.77	x	1.85	x	59.25	x	0.63	x	0.7	=	33.5	(74)
North	0.9x	0.77	x	1.85	x	59.25	x	0.63	x	0.7	=	33.5	(74)
North	0.9x	0.77	x	1.85	x	41.52	x	0.63	x	0.7	=	23.47	(74)
North	0.9x	0.77	x	1.85	x	41.52	x	0.63	x	0.7	=	23.47	(74)
North	0.9x	0.77	x	1.85	x	41.52	x	0.63	x	0.7	=	23.47	(74)
North	0.9x	0.77	x	1.85	x	24.19	x	0.63	x	0.7	=	13.68	(74)
North	0.9x	0.77	x	1.85	x	24.19	x	0.63	x	0.7	=	13.68	(74)
North	0.9x	0.77	x	1.85	x	24.19	x	0.63	x	0.7	=	13.68	(74)
North	0.9x	0.77	x	1.85	x	13.12	x	0.63	x	0.7	=	7.42	(74)
North	0.9x	0.77	x	1.85	x	13.12	x	0.63	x	0.7	=	7.42	(74)
North	0.9x	0.77	x	1.85	x	13.12	x	0.63	x	0.7	=	7.42	(74)
North	0.9x	0.77	x	1.85	x	8.86	x	0.63	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	1.85	x	8.86	x	0.63	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	1.85	x	8.86	x	0.63	x	0.7	=	5.01	(74)
East	0.9x	1	x	1.85	x	19.64	x	0.63	x	0.7	=	11.1	(76)
East	0.9x	1	x	1.85	x	19.64	x	0.63	x	0.7	=	11.1	(76)
East	0.9x	1	x	1.85	x	19.64	x	0.63	x	0.7	=	11.1	(76)

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East	0.9x	1	x	1.85	x	38.42	x	0.63	x	0.7	=	21.72	(76)
East	0.9x	1	x	1.85	x	38.42	x	0.63	x	0.7	=	21.72	(76)
East	0.9x	1	x	1.85	x	38.42	x	0.63	x	0.7	=	21.72	(76)
East	0.9x	1	x	1.85	x	63.27	x	0.63	x	0.7	=	35.77	(76)
East	0.9x	1	x	1.85	x	63.27	x	0.63	x	0.7	=	35.77	(76)
East	0.9x	1	x	1.85	x	63.27	x	0.63	x	0.7	=	35.77	(76)
East	0.9x	1	x	1.85	x	92.28	x	0.63	x	0.7	=	52.17	(76)
East	0.9x	1	x	1.85	x	92.28	x	0.63	x	0.7	=	52.17	(76)
East	0.9x	1	x	1.85	x	92.28	x	0.63	x	0.7	=	52.17	(76)
East	0.9x	1	x	1.85	x	113.09	x	0.63	x	0.7	=	63.94	(76)
East	0.9x	1	x	1.85	x	113.09	x	0.63	x	0.7	=	63.94	(76)
East	0.9x	1	x	1.85	x	113.09	x	0.63	x	0.7	=	63.94	(76)
East	0.9x	1	x	1.85	x	115.77	x	0.63	x	0.7	=	65.45	(76)
East	0.9x	1	x	1.85	x	115.77	x	0.63	x	0.7	=	65.45	(76)
East	0.9x	1	x	1.85	x	115.77	x	0.63	x	0.7	=	65.45	(76)
East	0.9x	1	x	1.85	x	110.22	x	0.63	x	0.7	=	62.32	(76)
East	0.9x	1	x	1.85	x	110.22	x	0.63	x	0.7	=	62.32	(76)
East	0.9x	1	x	1.85	x	110.22	x	0.63	x	0.7	=	62.32	(76)
East	0.9x	1	x	1.85	x	94.68	x	0.63	x	0.7	=	53.53	(76)
East	0.9x	1	x	1.85	x	94.68	x	0.63	x	0.7	=	53.53	(76)
East	0.9x	1	x	1.85	x	94.68	x	0.63	x	0.7	=	53.53	(76)
East	0.9x	1	x	1.85	x	73.59	x	0.63	x	0.7	=	41.61	(76)
East	0.9x	1	x	1.85	x	73.59	x	0.63	x	0.7	=	41.61	(76)
East	0.9x	1	x	1.85	x	73.59	x	0.63	x	0.7	=	41.61	(76)
East	0.9x	1	x	1.85	x	45.59	x	0.63	x	0.7	=	25.78	(76)
East	0.9x	1	x	1.85	x	45.59	x	0.63	x	0.7	=	25.78	(76)
East	0.9x	1	x	1.85	x	45.59	x	0.63	x	0.7	=	25.78	(76)
East	0.9x	1	x	1.85	x	24.49	x	0.63	x	0.7	=	13.85	(76)
East	0.9x	1	x	1.85	x	24.49	x	0.63	x	0.7	=	13.85	(76)
East	0.9x	1	x	1.85	x	24.49	x	0.63	x	0.7	=	13.85	(76)
East	0.9x	1	x	1.85	x	16.15	x	0.63	x	0.7	=	9.13	(76)
East	0.9x	1	x	1.85	x	16.15	x	0.63	x	0.7	=	9.13	(76)
East	0.9x	1	x	1.85	x	16.15	x	0.63	x	0.7	=	9.13	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	51.35	99.63	165.89	250.6	318.55	332.03	313.61	261.08	195.24	118.36	63.79	42.43	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	377.94	424.52	480.79	549.5	601.46	599.31	570.59	522.95	465.2	404.49	368.5	360.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	1	0.99	0.98	0.95	0.87	0.71	0.55	0.61	0.85	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.48	19.64	19.93	20.34	20.7	20.91	20.98	20.96	20.79	20.34	19.84	19.45	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.73	19.73	19.73	19.74	19.74	19.75	19.75	19.75	19.75	19.74	19.74	19.73	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.98	0.93	0.81	0.6	0.41	0.47	0.77	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.74	17.97	18.4	18.98	19.45	19.69	19.74	19.74	19.59	18.99	18.27	17.7	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.61	18.8	19.16	19.66	20.07	20.3	20.36	20.35	20.19	19.66	19.06	18.58	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.61	18.8	19.16	19.66	20.07	20.3	20.36	20.35	20.19	19.66	19.06	18.58	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.93	0.83	0.65	0.48	0.54	0.8	0.95	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	375.07	419.05	467.57	510.51	498.06	391.64	273.81	283.06	373.15	385.4	363.56	358.56	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1094.84	1061.53	965.09	812.01	630.82	425.98	280.89	294.7	456.43	682.88	904.1	1091.34	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	535.51	431.74	370.15	217.08	98.77	0	0	0	0	221.33	389.19	545.19	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2808.96 (98)

Space heating requirement in kWh/m²/year 53.21 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	535.51	431.74	370.15	217.08	98.77	0	0	0	0	221.33	389.19	545.19	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	572.74	461.76	395.89	232.17	105.64	0	0	0	0	236.71	416.24	583.09	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3004.24 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

171.05	150.94	158.92	143.02	140.56	126.17	121.73	132.81	132.34	148.27	156.08	167.12

Efficiency of water heater 79.8 (216)

(217)m=	87.65	87.46	87	85.92	83.89	79.8	79.8	79.8	79.8	85.88	87.15	87.74	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.14	172.57	182.67	166.45	167.54	158.11	152.54	166.43	165.84	172.65	179.09	190.48

Total = Sum(219a)$_{1...12}$ = 2069.52 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3004.24	
Water heating fuel used		2069.52	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		243.85	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	648.91	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	447.02	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1095.93	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	126.56	(268)
Total CO2, kg/year		sum of (265)…(271) =		1261.42	(272)

TER = 23.89 (273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-13-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	54.69	(1a) x	2.4	(2a) =	131.26	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54.69	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	131.26	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			6.93	x1/[1/(1.2)+ 0.04]		=	7.94			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	39.6	16.13	23.47	x	0.18	=	4.22			(29)
Walls Type2	33.71	2.1	31.61	x	0.18	=	5.69			(29)
Roof	54.69	0	54.69	x	0.11	=	6.02			(30)
Total area of elements, m²			128							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 36.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.25 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 51.17 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	72.83	72.83	72.83	72.83	72.83	72.83	72.83	72.83	72.83	72.83	72.83	72.83	

Average = Sum(39)$_{1...12}$ /12= 72.83 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	

Average = Sum(40)$_{1...12}$ /12= 1.33 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.83 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.62 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	85.38	82.28	79.17	76.07	72.96	69.86	69.86	72.96	76.07	79.17	82.28	85.38	

Total = Sum(44)$_{1...12}$ = 931.46 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	126.62	110.74	114.28	99.63	95.6	82.49	76.44	87.72	88.77	103.45	112.92	122.63	

Total = Sum(45)$_{1...12}$ = 1221.29 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.99	16.61	17.14	14.94	14.34	12.37	11.47	13.16	13.31	15.52	16.94	18.39	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.9	160.67	169.55	153.12	150.87	135.99	131.72	143	142.26	158.73	166.42	177.9	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.9	160.67	169.55	153.12	150.87	135.99	131.72	143	142.26	158.73	166.42	177.9

Output from water heater (annual)$_{1...12}$	1872.13	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.32	76.76	82.22	75.92	76.01	70.22	69.64	73.39	72.31	78.62	80.34	84.99	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	14.21	12.62	10.26	7.77	5.81	4.9	5.3	6.89	9.24	11.74	13.7	14.6	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	159.39	161.04	156.87	148	136.8	126.27	119.24	117.59	121.75	130.63	141.83	152.35	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	(71)
Water heating gains (Table 5)													
(72)m=	116.03	114.23	110.51	105.45	102.16	97.53	93.6	98.64	100.43	105.67	111.59	114.24	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	340.05	338.32	328.07	311.64	295.19	279.13	268.56	273.54	281.85	298.46	317.54	331.62	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(76)
East	0.9x	1	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(76)

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East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(76)
East	0.9x	1	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(76)
East	0.9x	1	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(76)
East	0.9x	1	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(76)
East	0.9x	1	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(76)
East	0.9x	1	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(76)
East	0.9x	1	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(76)
East	0.9x	1	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(76)
East	0.9x	1	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(76)
East	0.9x	1	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(76)
East	0.9x	1	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)

East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(76)
East	0.9x	1	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	6.93	x	46.75	x	0.5	x	0.8	=	89.81	(78)
South	0.9x	0.77	x	6.93	x	76.57	x	0.5	x	0.8	=	147.09	(78)
South	0.9x	0.77	x	6.93	x	97.53	x	0.5	x	0.8	=	187.36	(78)
South	0.9x	0.77	x	6.93	x	110.23	x	0.5	x	0.8	=	211.76	(78)
South	0.9x	0.77	x	6.93	x	114.87	x	0.5	x	0.8	=	220.67	(78)
South	0.9x	0.77	x	6.93	x	110.55	x	0.5	x	0.8	=	212.36	(78)
South	0.9x	0.77	x	6.93	x	108.01	x	0.5	x	0.8	=	207.49	(78)
South	0.9x	0.77	x	6.93	x	104.89	x	0.5	x	0.8	=	201.5	(78)
South	0.9x	0.77	x	6.93	x	101.89	x	0.5	x	0.8	=	195.72	(78)
South	0.9x	0.77	x	6.93	x	82.59	x	0.5	x	0.8	=	158.65	(78)
South	0.9x	0.77	x	6.93	x	55.42	x	0.5	x	0.8	=	106.46	(78)
South	0.9x	0.77	x	6.93	x	40.4	x	0.5	x	0.8	=	77.6	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	139.9	245.07	348.72	447.1	509.08	507.6	488.57	442.95	383.39	274.91	168.91	118.79	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	479.94	583.39	676.79	758.74	804.27	786.74	757.14	716.49	665.24	573.37	486.45	450.42	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.87	0.74	0.57	0.42	0.46	0.69	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.77	20	20.31	20.64	20.86	20.97	20.99	20.99	20.93	20.61	20.11	19.71	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.82	19.82	19.82	19.82	19.82	19.82	19.82	19.82	19.82	19.82	19.82	19.82	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.84	0.67	0.47	0.31	0.35	0.59	0.88	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.22	18.55	18.99	19.42	19.7	19.8	19.81	19.81	19.77	19.4	18.71	18.13	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.99	19.27	19.65	20.03	20.28	20.38	20.4	20.4	20.35	20.01	19.41	18.92	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.99	19.27	19.65	20.03	20.28	20.38	20.4	20.4	20.35	20.01	19.41	18.92	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.98	0.97	0.93	0.84	0.7	0.52	0.36	0.4	0.64	0.88	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	472.54	563.73	627.44	639.88	564.81	408.8	275.06	288.3	424.9	505.69	471.52	444.99	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1070.09	1046.82	957.54	810.59	624.97	421.13	277.02	291.41	454.86	685.04	896.61	1072.11	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	444.57	324.64	245.59	122.91	44.76	0	0	0	0	133.44	306.07	466.58

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2088.55	(98)
Space heating requirement in kWh/m²/year	38.19	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2088.55	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2192.97	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1872.13	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1965.73	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	41.59	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		35.39	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	35.39	(331)

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Energy for lighting (calculated in Appendix L)				250.94	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	= 965.89	(367)
Electrical energy for heat distribution	[(313) x		0.52	= 21.58	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			= 987.48	(373)
CO2 associated with space heating (secondary)	(309) x		0	= 0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	= 0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			987.48	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	= 18.37	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	= 130.24	(379)
Total CO2, kg/year	sum of (376)…(382) =			1136.08	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			20.77	(384)
EI rating (section 14)				84.73	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-13-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	54.69	(1a)	x	2.4	(2a)	=	131.26	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54.69	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	131.26	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.32	0.32	0.32	0.34	0.37	0.38	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.32	x1/[1/(1.4)+ 0.04]		=	1.75			(27)
Windows Type 2			1.32	x1/[1/(1.4)+ 0.04]		=	1.75			(27)
Windows Type 3			4.97	x1/[1/(1.4)+ 0.04]		=	6.59			(27)
Windows Type 4			1.98	x1/[1/(1.4)+ 0.04]		=	2.62			(27)
Windows Type 5			1.98	x1/[1/(1.4)+ 0.04]		=	2.62			(27)
Walls Type1	39.6	11.57	28.03	x	0.18	=	5.05			(29)
Walls Type2	33.71	2.1	31.61	x	0.18	=	5.69			(29)
Roof	54.69	0	54.69	x	0.13	=	7.11			(30)
Total area of elements, m²			128							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 17.42 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 52.7 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	25.78	25.62	25.46	24.72	24.58	23.94	23.94	23.82	24.19	24.58	24.86	25.15	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.48	78.32	78.16	77.43	77.29	76.65	76.65	76.53	76.9	77.29	77.57	77.86	

Average = Sum(39)$_{1…12}$ /12= 77.43 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.44	1.43	1.43	1.42	1.41	1.4	1.4	1.4	1.41	1.41	1.42	1.42	

Average = Sum(40)$_{1…12}$ /12= 1.42 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.83 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.62 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	85.38	82.28	79.17	76.07	72.96	69.86	69.86	72.96	76.07	79.17	82.28	85.38	

Total = Sum(44)$_{1…12}$ = 931.46 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	126.62	110.74	114.28	99.63	95.6	82.49	76.44	87.72	88.77	103.45	112.92	122.63	

Total = Sum(45)$_{1…12}$ = 1221.29 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.99	16.61	17.14	14.94	14.34	12.37	11.47	13.16	13.31	15.52	16.94	18.39	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	173.22	152.83	160.87	144.72	142.19	127.59	123.04	134.31	133.86	150.04	158.01	169.22	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	173.22	152.83	160.87	144.72	142.19	127.59	123.04	134.31	133.86	150.04	158.01	169.22

Output from water heater (annual)$_{1...12}$ | 1769.9 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	79.38	70.49	75.27	69.2	69.06	63.5	62.69	66.44	65.59	71.67	73.62	78.05	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.24	12.65	10.29	7.79	5.82	4.91	5.31	6.9	9.26	11.76	13.73	14.64	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	159.39	161.04	156.87	148	136.8	126.27	119.24	117.59	121.75	130.63	141.83	152.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	(71)

Water heating gains (Table 5)

(72)m=	106.69	104.9	101.17	96.11	92.83	88.2	84.26	89.3	91.09	96.33	102.25	104.9	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	333.74	332.01	321.76	305.32	288.87	272.81	262.24	267.22	275.54	292.15	311.23	325.32	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	1.32	x	19.64	x	0.63	x	0.7	=	7.92	(76)
East	0.9x	1	x	1.32	x	19.64	x	0.63	x	0.7	=	7.92	(76)

East	0.9x	1	x	1.98	x	19.64	x	0.63	x	0.7	=	11.88	(76)
East	0.9x	1	x	1.98	x	19.64	x	0.63	x	0.7	=	11.88	(76)
East	0.9x	1	x	1.32	x	38.42	x	0.63	x	0.7	=	15.5	(76)
East	0.9x	1	x	1.32	x	38.42	x	0.63	x	0.7	=	15.5	(76)
East	0.9x	1	x	1.98	x	38.42	x	0.63	x	0.7	=	23.25	(76)
East	0.9x	1	x	1.98	x	38.42	x	0.63	x	0.7	=	23.25	(76)
East	0.9x	1	x	1.32	x	63.27	x	0.63	x	0.7	=	25.52	(76)
East	0.9x	1	x	1.32	x	63.27	x	0.63	x	0.7	=	25.52	(76)
East	0.9x	1	x	1.98	x	63.27	x	0.63	x	0.7	=	38.29	(76)
East	0.9x	1	x	1.98	x	63.27	x	0.63	x	0.7	=	38.29	(76)
East	0.9x	1	x	1.32	x	92.28	x	0.63	x	0.7	=	37.23	(76)
East	0.9x	1	x	1.32	x	92.28	x	0.63	x	0.7	=	37.23	(76)
East	0.9x	1	x	1.98	x	92.28	x	0.63	x	0.7	=	55.84	(76)
East	0.9x	1	x	1.98	x	92.28	x	0.63	x	0.7	=	55.84	(76)
East	0.9x	1	x	1.32	x	113.09	x	0.63	x	0.7	=	45.62	(76)
East	0.9x	1	x	1.32	x	113.09	x	0.63	x	0.7	=	45.62	(76)
East	0.9x	1	x	1.98	x	113.09	x	0.63	x	0.7	=	68.43	(76)
East	0.9x	1	x	1.98	x	113.09	x	0.63	x	0.7	=	68.43	(76)
East	0.9x	1	x	1.32	x	115.77	x	0.63	x	0.7	=	46.7	(76)
East	0.9x	1	x	1.32	x	115.77	x	0.63	x	0.7	=	46.7	(76)
East	0.9x	1	x	1.98	x	115.77	x	0.63	x	0.7	=	70.05	(76)
East	0.9x	1	x	1.98	x	115.77	x	0.63	x	0.7	=	70.05	(76)
East	0.9x	1	x	1.32	x	110.22	x	0.63	x	0.7	=	44.46	(76)
East	0.9x	1	x	1.32	x	110.22	x	0.63	x	0.7	=	44.46	(76)
East	0.9x	1	x	1.98	x	110.22	x	0.63	x	0.7	=	66.69	(76)
East	0.9x	1	x	1.98	x	110.22	x	0.63	x	0.7	=	66.69	(76)
East	0.9x	1	x	1.32	x	94.68	x	0.63	x	0.7	=	38.19	(76)
East	0.9x	1	x	1.32	x	94.68	x	0.63	x	0.7	=	38.19	(76)
East	0.9x	1	x	1.98	x	94.68	x	0.63	x	0.7	=	57.29	(76)
East	0.9x	1	x	1.98	x	94.68	x	0.63	x	0.7	=	57.29	(76)
East	0.9x	1	x	1.32	x	73.59	x	0.63	x	0.7	=	29.69	(76)
East	0.9x	1	x	1.32	x	73.59	x	0.63	x	0.7	=	29.69	(76)
East	0.9x	1	x	1.98	x	73.59	x	0.63	x	0.7	=	44.53	(76)
East	0.9x	1	x	1.98	x	73.59	x	0.63	x	0.7	=	44.53	(76)
East	0.9x	1	x	1.32	x	45.59	x	0.63	x	0.7	=	18.39	(76)
East	0.9x	1	x	1.32	x	45.59	x	0.63	x	0.7	=	18.39	(76)
East	0.9x	1	x	1.98	x	45.59	x	0.63	x	0.7	=	27.59	(76)
East	0.9x	1	x	1.98	x	45.59	x	0.63	x	0.7	=	27.59	(76)
East	0.9x	1	x	1.32	x	24.49	x	0.63	x	0.7	=	9.88	(76)
East	0.9x	1	x	1.32	x	24.49	x	0.63	x	0.7	=	9.88	(76)
East	0.9x	1	x	1.98	x	24.49	x	0.63	x	0.7	=	14.82	(76)

East	0.9x	1	x	1.98	x	24.49	x	0.63	x	0.7	=	14.82	(76)
East	0.9x	1	x	1.32	x	16.15	x	0.63	x	0.7	=	6.52	(76)
East	0.9x	1	x	1.32	x	16.15	x	0.63	x	0.7	=	6.52	(76)
East	0.9x	1	x	1.98	x	16.15	x	0.63	x	0.7	=	9.77	(76)
East	0.9x	1	x	1.98	x	16.15	x	0.63	x	0.7	=	9.77	(76)
South	0.9x	0.77	x	4.97	x	46.75	x	0.63	x	0.7	=	71.01	(78)
South	0.9x	0.77	x	4.97	x	76.57	x	0.63	x	0.7	=	116.3	(78)
South	0.9x	0.77	x	4.97	x	97.53	x	0.63	x	0.7	=	148.14	(78)
South	0.9x	0.77	x	4.97	x	110.23	x	0.63	x	0.7	=	167.43	(78)
South	0.9x	0.77	x	4.97	x	114.87	x	0.63	x	0.7	=	174.48	(78)
South	0.9x	0.77	x	4.97	x	110.55	x	0.63	x	0.7	=	167.91	(78)
South	0.9x	0.77	x	4.97	x	108.01	x	0.63	x	0.7	=	164.06	(78)
South	0.9x	0.77	x	4.97	x	104.89	x	0.63	x	0.7	=	159.32	(78)
South	0.9x	0.77	x	4.97	x	101.89	x	0.63	x	0.7	=	154.75	(78)
South	0.9x	0.77	x	4.97	x	82.59	x	0.63	x	0.7	=	125.44	(78)
South	0.9x	0.77	x	4.97	x	55.42	x	0.63	x	0.7	=	84.17	(78)
South	0.9x	0.77	x	4.97	x	40.4	x	0.63	x	0.7	=	61.36	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	110.63	193.79	275.77	353.57	402.59	401.43	386.37	350.29	303.19	217.39	133.57	93.94	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	444.37	525.81	597.53	658.89	691.46	674.23	648.61	617.51	578.72	509.54	444.8	419.26	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.92	0.83	0.67	0.5	0.55	0.77	0.94	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.58	19.79	20.09	20.46	20.76	20.93	20.98	20.98	20.86	20.47	19.95	19.54	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.74	19.74	19.74	19.75	19.75	19.76	19.76	19.76	19.76	19.75	19.75	19.75	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.89	0.77	0.56	0.37	0.41	0.68	0.92	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.89	18.19	18.63	19.15	19.53	19.72	19.76	19.76	19.66	19.18	18.44	17.84	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.74	18.99	19.36	19.8	20.14	20.33	20.37	20.37	20.26	19.82	19.2	18.69	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.74	18.99	19.36	19.8	20.14	20.33	20.37	20.37	20.26	19.82	19.2	18.69	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

TER WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.99	0.98	0.95	0.9	0.79	0.61	0.44	0.48	0.72	0.92	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	439.16	513.61	568.95	590.07	543.72	411.97	283.98	296.12	418.13	467.88	434.91	415.32	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1133.02	1103.5	1005.36	844.33	652.63	438.88	288.99	303.53	473.89	712.85	938.43	1128.4	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	516.23	396.41	324.69	183.06	81.03	0	0	0	0	182.26	362.53	530.53

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2576.75 (98)

Space heating requirement in kWh/m²/year 47.12 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	516.23	396.41	324.69	183.06	81.03	0	0	0	0	182.26	362.53	530.53	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	552.12	423.96	347.26	195.79	86.67	0	0	0	0	194.93	387.74	567.41	(211)

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2755.88 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

173.22	152.83	160.87	144.72	142.19	127.59	123.04	134.31	133.86	150.04	158.01	169.22

Efficiency of water heater 79.8 (216)

(217)m=	87.55	87.24	86.65	85.44	83.38	79.8	79.8	79.8	79.8	85.33	86.96	87.66	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	197.85	175.17	185.66	169.38	170.54	159.88	154.18	168.31	167.74	175.83	181.71	193.05

Total = Sum(219a)$_{1...12}$ = 2099.3 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2755.88
Water heating fuel used		2099.3
Electricity for pumps, fans and electric keep-hot		

central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			251.51	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	595.27	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	453.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1048.72	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	130.53	(268)
Total CO2, kg/year		sum of (265)…(271) =		1218.18	(272)

TER = 22.27 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-13-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	52.6	(1a) x	2.4	(2a) =	126.24	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.6	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	126.24	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			6.99	x1/[1/(1.2)+ 0.04]		=	8			(27)
Walls Type1	35.49	15.27	20.22	x	0.18	=	3.64			(29)
Walls Type2	26.7	2.1	24.6	x	0.18	=	4.43			(29)
Roof	52.6	0	52.6	x	0.11	=	5.79			(30)
Total area of elements, m²			114.79							(31)
Party wall			15.58	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.86 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.48 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 46.34 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=	20.83	20.83	20.83	20.83	20.83	20.83	20.83	20.83	20.83	20.83	20.83	20.83	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	67.17	67.17	67.17	67.17	67.17	67.17	67.17	67.17	67.17	67.17	67.17	67.17	

Average = Sum(39)$_{1...12}$ /12= 67.17 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	

Average = Sum(40)$_{1...12}$ /12= 1.28 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.77 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 76.16 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	83.78	80.73	77.68	74.64	71.59	68.54	68.54	71.59	74.64	77.68	80.73	83.78	

Total = Sum(44)$_{1...12}$ = 913.93 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	124.24	108.66	112.13	97.76	93.8	80.94	75	86.07	87.1	101.5	110.8	120.32	

Total = Sum(45)$_{1...12}$ = 1198.31 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.64	16.3	16.82	14.66	14.07	12.14	11.25	12.91	13.06	15.23	16.62	18.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3												0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.52	158.59	167.4	151.25	149.08	134.43	130.28	141.34	140.59	156.78	164.29	175.6	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.52	158.59	167.4	151.25	149.08	134.43	130.28	141.34	140.59	156.78	164.29	175.6

Output from water heater (annual)$_{1...12}$ | 1849.15 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.53	76.07	81.5	75.3	75.41	69.71	69.16	72.84	71.75	77.97	79.63	84.23	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.73	12.19	9.92	7.51	5.61	4.74	5.12	6.65	8.93	11.34	13.24	14.11	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	153.98	155.58	151.55	142.98	132.16	121.99	115.2	113.6	117.63	126.2	137.02	147.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	(71)

Water heating gains (Table 5)

(72)m=	114.96	113.2	109.55	104.58	101.36	96.82	92.96	97.9	99.66	104.8	110.6	113.21	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	332.17	330.48	320.52	304.57	288.63	273.05	262.77	267.66	275.72	291.84	310.36	324.01	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	6.99	x	46.75	x	0.5	x	0.8	=	90.59	(78)
South	0.9x	0.77	x	6.99	x	76.57	x	0.5	x	0.8	=	148.36	(78)

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South	0.9x	0.77	x	6.99	x	97.53	x	0.5	x	0.8	=	188.98	(78)
South	0.9x	0.77	x	6.99	x	110.23	x	0.5	x	0.8	=	213.59	(78)
South	0.9x	0.77	x	6.99	x	114.87	x	0.5	x	0.8	=	222.58	(78)
South	0.9x	0.77	x	6.99	x	110.55	x	0.5	x	0.8	=	214.2	(78)
South	0.9x	0.77	x	6.99	x	108.01	x	0.5	x	0.8	=	209.29	(78)
South	0.9x	0.77	x	6.99	x	104.89	x	0.5	x	0.8	=	203.25	(78)
South	0.9x	0.77	x	6.99	x	101.89	x	0.5	x	0.8	=	197.42	(78)
South	0.9x	0.77	x	6.99	x	82.59	x	0.5	x	0.8	=	160.02	(78)
South	0.9x	0.77	x	6.99	x	55.42	x	0.5	x	0.8	=	107.38	(78)
South	0.9x	0.77	x	6.99	x	40.4	x	0.5	x	0.8	=	78.28	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)

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West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	135.67	236.54	334.21	425.4	482.15	479.92	462.26	420.55	366.32	264.66	163.59	115.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	467.84	567.02	654.73	729.97	770.78	752.96	725.04	688.2	642.04	556.49	473.94	439.35	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.86	0.73	0.55	0.4	0.44	0.67	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.85	20.08	20.38	20.68	20.89	20.97	21	20.99	20.94	20.66	20.18	19.79	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.86	19.86	19.86	19.86	19.86	19.86	19.86	19.86	19.86	19.86	19.86	19.86	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.83	0.66	0.46	0.3	0.34	0.58	0.86	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.37	18.69	19.11	19.52	19.76	19.84	19.86	19.86	19.82	19.5	18.84	18.28	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.11	19.39	19.74	20.1	20.32	20.41	20.43	20.42	20.38	20.08	19.51	19.04	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.11	19.39	19.74	20.1	20.32	20.41	20.43	20.42	20.38	20.08	19.51	19.04	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.92	0.83	0.69	0.51	0.35	0.39	0.62	0.87	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	460.16	546.57	603.77	609.07	531.23	381	255.63	268.13	398.92	485.66	458.29	433.74	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	994.68	972.97	889.58	752.26	579.26	390.21	257	270.31	421.8	636.61	833.66	996.55	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	397.68	286.54	212.64	103.1	35.73	0	0	0	0	112.3	270.27	418.73	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1837 | (98)

Space heating requirement in kWh/m²/year | 34.92 | (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1837	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1928.85	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1849.15	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1941.6	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	38.7	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		34.04	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	34.04	(331)
Energy for lighting (calculated in Appendix L)		242.43	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	898.94	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	20.09	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	919.03	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				919.03	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	17.67	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	125.82	(379)
Total CO2, kg/year	sum of (376)…(382) =			1062.52	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			20.2	(384)
EI rating (section 14)				85.41	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-13-03

Address :	Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	52.6	(1a) x	2.4	(2a) =	126.24	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.6	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	126.24	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.43	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2	x1/[1/(1.4)+ 0.04]		=	2.65			(27)
Windows Type 2			2	x1/[1/(1.4)+ 0.04]		=	2.65			(27)
Windows Type 3			2	x1/[1/(1.4)+ 0.04]		=	2.65			(27)
Windows Type 4			5.06	x1/[1/(1.4)+ 0.04]		=	6.71			(27)
Walls Type1	35.49	11.06	24.43	x	0.18	=	4.4			(29)
Walls Type2	26.7	2.1	24.6	x	0.18	=	4.43			(29)
Roof	52.6	0	52.6	x	0.13	=	6.84			(30)
Total area of elements, m²			114.79							(31)
Party wall			15.58	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	32.43	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		15.01	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	47.44	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	24.91	24.75	24.6	23.87	23.73	23.1	23.1	22.98	23.34	23.73	24.01	24.3	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	72.35	72.19	72.03	71.3	71.17	70.53	70.53	70.41	70.78	71.17	71.44	71.73	

Average = Sum(39)$_{1...12}$ /12= 71.3 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.38	1.37	1.37	1.36	1.35	1.34	1.34	1.34	1.35	1.35	1.36	1.36

Average = Sum(40)$_{1...12}$ /12= 1.36 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.77 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 76.16 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	83.78	80.73	77.68	74.64	71.59	68.54	68.54	71.59	74.64	77.68	80.73	83.78

Total = Sum(44)$_{1...12}$ = 913.93 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	124.24	108.66	112.13	97.76	93.8	80.94	75	86.07	87.1	101.5	110.8	120.32

Total = Sum(45)$_{1...12}$ = 1198.31 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.64	16.3	16.82	14.66	14.07	12.14	11.25	12.91	13.06	15.23	16.62	18.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	170.83	150.75	158.72	142.85	140.39	126.03	121.6	132.66	132.19	148.1	155.89	166.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	170.83	150.75	158.72	142.85	140.39	126.03	121.6	132.66	132.19	148.1	155.89	166.91

Output from water heater (annual)$_{1...12}$ | 1746.92 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	78.59	69.8	74.56	68.58	68.46	62.99	62.21	65.89	65.03	71.03	72.91	77.28	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.76	12.23	9.94	7.53	5.63	4.75	5.13	6.67	8.95	11.37	13.27	14.15	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	153.98	155.58	151.55	142.98	132.16	121.99	115.2	113.6	117.63	126.2	137.02	147.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	(71)

Water heating gains (Table 5)

(72)m=	105.63	103.87	100.21	95.25	92.02	87.48	83.62	88.57	90.32	95.46	101.27	103.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	325.87	324.17	314.21	298.26	282.31	266.72	256.45	261.34	269.4	285.53	304.06	317.71	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	5.06	x	46.75	x	0.63	x	0.7	=	72.3	(78)
South	0.9x	0.77	x	5.06	x	76.57	x	0.63	x	0.7	=	118.4	(78)

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South	0.9x	0.77	x	5.06	x	97.53	x	0.63	x	0.7	=	150.83	(78)
South	0.9x	0.77	x	5.06	x	110.23	x	0.63	x	0.7	=	170.47	(78)
South	0.9x	0.77	x	5.06	x	114.87	x	0.63	x	0.7	=	177.64	(78)
South	0.9x	0.77	x	5.06	x	110.55	x	0.63	x	0.7	=	170.95	(78)
South	0.9x	0.77	x	5.06	x	108.01	x	0.63	x	0.7	=	167.03	(78)
South	0.9x	0.77	x	5.06	x	104.89	x	0.63	x	0.7	=	162.21	(78)
South	0.9x	0.77	x	5.06	x	101.89	x	0.63	x	0.7	=	157.56	(78)
South	0.9x	0.77	x	5.06	x	82.59	x	0.63	x	0.7	=	127.71	(78)
South	0.9x	0.77	x	5.06	x	55.42	x	0.63	x	0.7	=	85.7	(78)
South	0.9x	0.77	x	5.06	x	40.4	x	0.63	x	0.7	=	62.47	(78)
West	0.9x	0.77	x	2	x	19.64	x	0.63	x	0.7	=	12	(80)
West	0.9x	0.77	x	2	x	19.64	x	0.63	x	0.7	=	12	(80)
West	0.9x	0.77	x	2	x	19.64	x	0.63	x	0.7	=	12	(80)
West	0.9x	0.77	x	2	x	38.42	x	0.63	x	0.7	=	23.48	(80)
West	0.9x	0.77	x	2	x	38.42	x	0.63	x	0.7	=	23.48	(80)
West	0.9x	0.77	x	2	x	38.42	x	0.63	x	0.7	=	23.48	(80)
West	0.9x	0.77	x	2	x	63.27	x	0.63	x	0.7	=	38.67	(80)
West	0.9x	0.77	x	2	x	63.27	x	0.63	x	0.7	=	38.67	(80)
West	0.9x	0.77	x	2	x	63.27	x	0.63	x	0.7	=	38.67	(80)
West	0.9x	0.77	x	2	x	92.28	x	0.63	x	0.7	=	56.4	(80)
West	0.9x	0.77	x	2	x	92.28	x	0.63	x	0.7	=	56.4	(80)
West	0.9x	0.77	x	2	x	92.28	x	0.63	x	0.7	=	56.4	(80)
West	0.9x	0.77	x	2	x	113.09	x	0.63	x	0.7	=	69.13	(80)
West	0.9x	0.77	x	2	x	113.09	x	0.63	x	0.7	=	69.13	(80)
West	0.9x	0.77	x	2	x	113.09	x	0.63	x	0.7	=	69.13	(80)
West	0.9x	0.77	x	2	x	115.77	x	0.63	x	0.7	=	70.76	(80)
West	0.9x	0.77	x	2	x	115.77	x	0.63	x	0.7	=	70.76	(80)
West	0.9x	0.77	x	2	x	115.77	x	0.63	x	0.7	=	70.76	(80)
West	0.9x	0.77	x	2	x	110.22	x	0.63	x	0.7	=	67.37	(80)
West	0.9x	0.77	x	2	x	110.22	x	0.63	x	0.7	=	67.37	(80)
West	0.9x	0.77	x	2	x	110.22	x	0.63	x	0.7	=	67.37	(80)
West	0.9x	0.77	x	2	x	94.68	x	0.63	x	0.7	=	57.87	(80)
West	0.9x	0.77	x	2	x	94.68	x	0.63	x	0.7	=	57.87	(80)
West	0.9x	0.77	x	2	x	94.68	x	0.63	x	0.7	=	57.87	(80)
West	0.9x	0.77	x	2	x	73.59	x	0.63	x	0.7	=	44.98	(80)
West	0.9x	0.77	x	2	x	73.59	x	0.63	x	0.7	=	44.98	(80)
West	0.9x	0.77	x	2	x	73.59	x	0.63	x	0.7	=	44.98	(80)
West	0.9x	0.77	x	2	x	45.59	x	0.63	x	0.7	=	27.87	(80)
West	0.9x	0.77	x	2	x	45.59	x	0.63	x	0.7	=	27.87	(80)
West	0.9x	0.77	x	2	x	45.59	x	0.63	x	0.7	=	27.87	(80)
West	0.9x	0.77	x	2	x	24.49	x	0.63	x	0.7	=	14.97	(80)

West	0.9x	0.77	x	2	x	24.49	x	0.63	x	0.7	=	14.97	(80)
West	0.9x	0.77	x	2	x	24.49	x	0.63	x	0.7	=	14.97	(80)
West	0.9x	0.77	x	2	x	16.15	x	0.63	x	0.7	=	9.87	(80)
West	0.9x	0.77	x	2	x	16.15	x	0.63	x	0.7	=	9.87	(80)
West	0.9x	0.77	x	2	x	16.15	x	0.63	x	0.7	=	9.87	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	108.31	188.86	266.85	339.68	385.01	383.24	369.13	335.81	292.5	211.31	130.6	92.09	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	434.18	513.03	581.06	637.93	667.32	649.96	625.59	597.15	561.9	496.84	434.66	409.8	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.91	0.81	0.65	0.48	0.53	0.75	0.94	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.67	19.87	20.17	20.52	20.79	20.95	20.99	20.98	20.89	20.53	20.03	19.63	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.78	19.78	19.79	19.8	19.8	19.81	19.81	19.81	19.81	19.8	19.8	19.79	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.89	0.75	0.54	0.36	0.4	0.66	0.91	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.05	18.35	18.77	19.26	19.61	19.78	19.8	19.8	19.73	19.29	18.58	18	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.86	19.11	19.47	19.89	20.2	20.36	20.4	20.39	20.31	19.91	19.31	18.81	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.86	19.11	19.47	19.89	20.2	20.36	20.4	20.39	20.31	19.91	19.31	18.81	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.89	0.77	0.59	0.42	0.46	0.7	0.91	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	428.81	500.33	551.32	566.76	516.2	385.93	264.23	275.93	395.79	452.74	424.29	405.75	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1053.2	1025.73	934.3	783.71	605.06	406.3	267.76	281.2	439.35	662.31	871.99	1048.31	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	464.55	353.07	284.94	156.21	66.11	0	0	0	0	155.92	322.34	478.07	

Total per year (kWh/year) = $Sum(98)_{1…5,9…12}$ = 2281.21 (98)

Space heating requirement in kWh/m²/year 43.37 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	464.55	353.07	284.94	156.21	66.11	0	0	0	0	155.92	322.34	478.07		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	496.84	377.61	304.74	167.07	70.7	0	0	0	0	166.76	344.75	511.3		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2439.79	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	170.83	150.75	158.72	142.85	140.39	126.03	121.6	132.66	132.19	148.1	155.89	166.91		
Efficiency of water heater													79.8	(216)
(217)m=	87.35	87.01	86.36	85.05	82.94	79.8	79.8	79.8	79.8	84.95	86.71	87.46		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	195.57	173.25	183.8	167.95	169.27	157.94	152.38	166.24	165.65	174.33	179.78	190.83		
Total = Sum(219a)$_{1...12}$ =													2077	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2439.79	
Water heating fuel used			2077	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			243.08	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	527	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	448.63	(264)
Space and water heating	(261) + (262) + (263) + (264) =			975.63	(265)

Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	126.16	(268)
Total CO2, kg/year			sum of (265)…(271) =		1140.71	(272)

TER =	21.69	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-13-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.5	(1a) x	2.4	(2a) =	121.2	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.2	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 6			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	37.87	15.64	22.23	x	0.18	=	4			(29)
Walls Type2	19.95	2.1	17.85	x	0.18	=	3.21			(29)
Roof	50.5	0	50.5	x	0.11	=	5.55			(30)
Total area of elements, m²			108.32							(31)
Party wall			17.92	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.2 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.1 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 48.3 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20	20	20	20	20	20	20	20	20	20	20	20	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(39)m=	68.29	68.29	68.29	68.29	68.29	68.29	68.29	68.29	68.29	68.29	68.29	68.29

Average = Sum(39)$_{1...12}$ /12= 68.29 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(40)m=	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35

Average = Sum(40)$_{1...12}$ /12= 1.35 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.69 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	82.16	79.17	76.18	73.2	70.21	67.22	67.22	70.21	73.2	76.18	79.17	82.16

Total = Sum(44)$_{1...12}$ = 896.28 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(45)m=	121.84	106.56	109.96	95.87	91.99	79.38	73.56	84.41	85.41	99.54	108.66	117.99

Total = Sum(45)$_{1...12}$ = 1175.16 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	18.28	15.98	16.49	14.38	13.8	11.91	11.03	12.66	12.81	14.93	16.3	17.7	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	177.12	156.49	165.24	149.36	147.26	132.87	128.83	139.68	138.91	154.82	162.15	173.27	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	177.12	156.49	165.24	149.36	147.26	132.87	128.83	139.68	138.91	154.82	162.15	173.27	

Output from water heater (annual)$_{1...12}$ — 1826 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.73	75.37	80.78	74.67	74.81	69.19	68.68	72.29	71.19	77.32	78.92	83.45	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.24	11.76	9.56	7.24	5.41	4.57	4.94	6.42	8.61	10.94	12.77	13.61	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.53	150.07	146.19	137.92	127.48	117.67	111.12	109.58	113.46	121.73	132.17	141.98	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	(71)

Water heating gains (Table 5)

(72)m=	113.89	112.16	108.58	103.71	100.55	96.09	92.31	97.16	98.88	103.92	109.62	112.17	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	324.24	322.57	312.91	297.44	282.02	266.91	256.94	261.73	269.53	285.17	303.12	316.33	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)

West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	66.77	129.64	215.67	324.96	412.01	428.9	405.33	338.18	253.61	153.99	82.97	55.16	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	391.01	452.21	528.58	622.41	694.02	695.81	662.27	599.9	523.14	439.15	386.09	371.49	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.99	0.97	0.91	0.78	0.6	0.45	0.51	0.77	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.65	19.83	20.14	20.53	20.83	20.96	20.99	20.98	20.88	20.48	19.98	19.61	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.88	0.71	0.5	0.33	0.38	0.68	0.93	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.04	18.3	18.75	19.28	19.65	19.78	19.8	19.79	19.71	19.22	18.52	17.97	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.84	19.06	19.44	19.91	20.24	20.37	20.39	20.39	20.29	19.85	19.25	18.79	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.84	19.06	19.44	19.91	20.24	20.37	20.39	20.39	20.29	19.85	19.25	18.79	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.88	0.74	0.55	0.39	0.45	0.72	0.93	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	387.15	443.74	505.3	549.94	512.52	379.45	256.61	267.85	376.79	407.99	378.98	368.51	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	993.35	967.25	884.08	751.86	583.11	393.91	259.11	272.45	423.06	631.56	829.85	996.3	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	451.01	351.8	281.81	145.38	52.52	0	0	0	0	166.33	324.62	467.08	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2240.55 (98)

Space heating requirement in kWh/m²/year 44.37 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers 1 (303a)

Fraction of total space heat from Community boilers (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 2240.55

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Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2352.58	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		1826	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1917.3	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	42.7	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		32.68	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	32.68	(331)
Energy for lighting (calculated in Appendix L)		233.85	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	991.71	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	22.16	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1013.87	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1013.87	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	16.96	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	121.37	(379)
Total CO2, kg/year	sum of (376)…(382) =				1152.2	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				22.82	(384)
EI rating (section 14)					83.83	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-13-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.5	(1a) x	2.4	(2a) =	121.2	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.5	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		121.2	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.86	x1/[1/(1.4)+ 0.04]		=	2.47			(27)
Windows Type 2			1.86	x1/[1/(1.4)+ 0.04]		=	2.47			(27)
Windows Type 3			1.86	x1/[1/(1.4)+ 0.04]		=	2.47			(27)
Windows Type 4			1.86	x1/[1/(1.4)+ 0.04]		=	2.47			(27)
Windows Type 5			1.86	x1/[1/(1.4)+ 0.04]		=	2.47			(27)
Windows Type 6			1.24	x1/[1/(1.4)+ 0.04]		=	1.64			(27)
Walls Type1	37.87	10.54	27.33	x	0.18	=	4.92			(29)
Walls Type2	19.95	2.1	17.85	x	0.18	=	3.21			(29)
Roof	50.5	0	50.5	x	0.13	=	6.56			(30)
Total area of elements, m²			108.32							(31)
Party wall			17.92	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.77 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 16.87 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

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Total fabric heat loss	(33) + (36) =	47.65	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	24.04	23.89	23.73	23.01	22.87	22.24	22.24	22.13	22.49	22.87	23.15	23.43	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	71.69	71.53	71.38	70.65	70.52	69.89	69.89	69.77	70.13	70.52	70.79	71.08	

Average = Sum(39)$_{1…12}$ /12= 70.65 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.42	1.42	1.41	1.4	1.4	1.38	1.38	1.38	1.39	1.4	1.4	1.41	

Average = Sum(40)$_{1…12}$ /12= 1.4 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.69 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	82.16	79.17	76.18	73.2	70.21	67.22	67.22	70.21	73.2	76.18	79.17	82.16

Total = Sum(44)$_{1…12}$ = 896.28 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.84	106.56	109.96	95.87	91.99	79.38	73.56	84.41	85.41	99.54	108.66	117.99

Total = Sum(45)$_{1…12}$ = 1175.16 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.28	15.98	16.49	14.38	13.8	11.91	11.03	12.66	12.81	14.93	16.3	17.7	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		150	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)			
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)			
Water storage loss:			
a) If manufacturer’s declared loss factor is known (kWh/day):		1.39	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0.75	(50)
b) If manufacturer’s declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.75	(55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.43	148.65	156.56	140.96	138.58	124.47	120.15	131	130.51	146.14	153.75	164.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.43	148.65	156.56	140.96	138.58	124.47	120.15	131	130.51	146.14	153.75	164.59	

Output from water heater (annual)$_{1...12}$ | 1723.78 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.79	69.1	73.84	67.95	67.86	62.47	61.73	65.34	64.47	70.37	72.2	76.51	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.28	11.8	9.6	7.26	5.43	4.58	4.95	6.44	8.64	10.97	12.81	13.65	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.53	150.07	146.19	137.92	127.48	117.67	111.12	109.58	113.46	121.73	132.17	141.98	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	(71)

Water heating gains (Table 5)

(72)m=	104.55	102.83	99.24	94.37	91.21	86.76	82.97	87.82	89.55	94.59	100.28	102.83	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	317.94	316.27	306.6	291.13	275.7	260.59	250.62	255.41	263.22	278.86	296.83	310.04	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d			Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.86	x	10.63	x	0.63	x	0.7	=	6.04	(74)
North	0.9x	0.77	x	1.86	x	10.63	x	0.63	x	0.7	=	6.04	(74)
North	0.9x	0.77	x	1.24	x	10.63	x	0.63	x	0.7	=	4.03	(74)
North	0.9x	0.77	x	1.86	x	20.32	x	0.63	x	0.7	=	11.55	(74)
North	0.9x	0.77	x	1.86	x	20.32	x	0.63	x	0.7	=	11.55	(74)
North	0.9x	0.77	x	1.24	x	20.32	x	0.63	x	0.7	=	7.7	(74)
North	0.9x	0.77	x	1.86	x	34.53	x	0.63	x	0.7	=	19.63	(74)
North	0.9x	0.77	x	1.86	x	34.53	x	0.63	x	0.7	=	19.63	(74)
North	0.9x	0.77	x	1.24	x	34.53	x	0.63	x	0.7	=	13.09	(74)
North	0.9x	0.77	x	1.86	x	55.46	x	0.63	x	0.7	=	31.53	(74)
North	0.9x	0.77	x	1.86	x	55.46	x	0.63	x	0.7	=	31.53	(74)
North	0.9x	0.77	x	1.24	x	55.46	x	0.63	x	0.7	=	21.02	(74)
North	0.9x	0.77	x	1.86	x	74.72	x	0.63	x	0.7	=	42.47	(74)
North	0.9x	0.77	x	1.86	x	74.72	x	0.63	x	0.7	=	42.47	(74)
North	0.9x	0.77	x	1.24	x	74.72	x	0.63	x	0.7	=	28.31	(74)
North	0.9x	0.77	x	1.86	x	79.99	x	0.63	x	0.7	=	45.47	(74)
North	0.9x	0.77	x	1.86	x	79.99	x	0.63	x	0.7	=	45.47	(74)
North	0.9x	0.77	x	1.24	x	79.99	x	0.63	x	0.7	=	30.31	(74)
North	0.9x	0.77	x	1.86	x	74.68	x	0.63	x	0.7	=	42.45	(74)
North	0.9x	0.77	x	1.86	x	74.68	x	0.63	x	0.7	=	42.45	(74)
North	0.9x	0.77	x	1.24	x	74.68	x	0.63	x	0.7	=	28.3	(74)
North	0.9x	0.77	x	1.86	x	59.25	x	0.63	x	0.7	=	33.68	(74)
North	0.9x	0.77	x	1.86	x	59.25	x	0.63	x	0.7	=	33.68	(74)
North	0.9x	0.77	x	1.24	x	59.25	x	0.63	x	0.7	=	22.45	(74)
North	0.9x	0.77	x	1.86	x	41.52	x	0.63	x	0.7	=	23.6	(74)
North	0.9x	0.77	x	1.86	x	41.52	x	0.63	x	0.7	=	23.6	(74)
North	0.9x	0.77	x	1.24	x	41.52	x	0.63	x	0.7	=	15.73	(74)
North	0.9x	0.77	x	1.86	x	24.19	x	0.63	x	0.7	=	13.75	(74)
North	0.9x	0.77	x	1.86	x	24.19	x	0.63	x	0.7	=	13.75	(74)
North	0.9x	0.77	x	1.24	x	24.19	x	0.63	x	0.7	=	9.17	(74)
North	0.9x	0.77	x	1.86	x	13.12	x	0.63	x	0.7	=	7.46	(74)
North	0.9x	0.77	x	1.86	x	13.12	x	0.63	x	0.7	=	7.46	(74)
North	0.9x	0.77	x	1.24	x	13.12	x	0.63	x	0.7	=	4.97	(74)
North	0.9x	0.77	x	1.86	x	8.86	x	0.63	x	0.7	=	5.04	(74)
North	0.9x	0.77	x	1.86	x	8.86	x	0.63	x	0.7	=	5.04	(74)
North	0.9x	0.77	x	1.24	x	8.86	x	0.63	x	0.7	=	3.36	(74)
West	0.9x	0.77	x	1.86	x	19.64	x	0.63	x	0.7	=	11.16	(80)
West	0.9x	0.77	x	1.86	x	19.64	x	0.63	x	0.7	=	11.16	(80)
West	0.9x	0.77	x	1.86	x	19.64	x	0.63	x	0.7	=	11.16	(80)

West	0.9x	0.77	x	1.86	x	38.42	x	0.63	x	0.7	=	21.84	(80)
West	0.9x	0.77	x	1.86	x	38.42	x	0.63	x	0.7	=	21.84	(80)
West	0.9x	0.77	x	1.86	x	38.42	x	0.63	x	0.7	=	21.84	(80)
West	0.9x	0.77	x	1.86	x	63.27	x	0.63	x	0.7	=	35.97	(80)
West	0.9x	0.77	x	1.86	x	63.27	x	0.63	x	0.7	=	35.97	(80)
West	0.9x	0.77	x	1.86	x	63.27	x	0.63	x	0.7	=	35.97	(80)
West	0.9x	0.77	x	1.86	x	92.28	x	0.63	x	0.7	=	52.46	(80)
West	0.9x	0.77	x	1.86	x	92.28	x	0.63	x	0.7	=	52.46	(80)
West	0.9x	0.77	x	1.86	x	92.28	x	0.63	x	0.7	=	52.46	(80)
West	0.9x	0.77	x	1.86	x	113.09	x	0.63	x	0.7	=	64.29	(80)
West	0.9x	0.77	x	1.86	x	113.09	x	0.63	x	0.7	=	64.29	(80)
West	0.9x	0.77	x	1.86	x	113.09	x	0.63	x	0.7	=	64.29	(80)
West	0.9x	0.77	x	1.86	x	115.77	x	0.63	x	0.7	=	65.81	(80)
West	0.9x	0.77	x	1.86	x	115.77	x	0.63	x	0.7	=	65.81	(80)
West	0.9x	0.77	x	1.86	x	115.77	x	0.63	x	0.7	=	65.81	(80)
West	0.9x	0.77	x	1.86	x	110.22	x	0.63	x	0.7	=	62.65	(80)
West	0.9x	0.77	x	1.86	x	110.22	x	0.63	x	0.7	=	62.65	(80)
West	0.9x	0.77	x	1.86	x	110.22	x	0.63	x	0.7	=	62.65	(80)
West	0.9x	0.77	x	1.86	x	94.68	x	0.63	x	0.7	=	53.82	(80)
West	0.9x	0.77	x	1.86	x	94.68	x	0.63	x	0.7	=	53.82	(80)
West	0.9x	0.77	x	1.86	x	94.68	x	0.63	x	0.7	=	53.82	(80)
West	0.9x	0.77	x	1.86	x	73.59	x	0.63	x	0.7	=	41.83	(80)
West	0.9x	0.77	x	1.86	x	73.59	x	0.63	x	0.7	=	41.83	(80)
West	0.9x	0.77	x	1.86	x	73.59	x	0.63	x	0.7	=	41.83	(80)
West	0.9x	0.77	x	1.86	x	45.59	x	0.63	x	0.7	=	25.91	(80)
West	0.9x	0.77	x	1.86	x	45.59	x	0.63	x	0.7	=	25.91	(80)
West	0.9x	0.77	x	1.86	x	45.59	x	0.63	x	0.7	=	25.91	(80)
West	0.9x	0.77	x	1.86	x	24.49	x	0.63	x	0.7	=	13.92	(80)
West	0.9x	0.77	x	1.86	x	24.49	x	0.63	x	0.7	=	13.92	(80)
West	0.9x	0.77	x	1.86	x	24.49	x	0.63	x	0.7	=	13.92	(80)
West	0.9x	0.77	x	1.86	x	16.15	x	0.63	x	0.7	=	9.18	(80)
West	0.9x	0.77	x	1.86	x	16.15	x	0.63	x	0.7	=	9.18	(80)
West	0.9x	0.77	x	1.86	x	16.15	x	0.63	x	0.7	=	9.18	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	49.61	96.32	160.24	241.44	306.12	318.67	301.16	251.26	188.43	114.41	61.65	40.98	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	367.55	412.6	466.85	532.57	581.81	579.26	551.78	506.67	451.65	393.28	358.48	351.02	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	1	0.99	0.98	0.95	0.86	0.7	0.54	0.6	0.84	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.53	19.68	19.98	20.38	20.72	20.92	20.98	20.97	20.81	20.37	19.88	19.5	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.75	19.75	19.75	19.76	19.77	19.78	19.78	19.78	19.77	19.77	19.76	19.76	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.93	0.8	0.59	0.4	0.46	0.76	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.82	18.05	18.48	19.05	19.5	19.73	19.77	19.77	19.63	19.06	18.35	17.79	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.67	18.87	19.23	19.71	20.11	20.32	20.37	20.37	20.22	19.71	19.12	18.64	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.67	18.87	19.23	19.71	20.11	20.32	20.37	20.37	20.22	19.71	19.12	18.64	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.92	0.82	0.64	0.47	0.53	0.79	0.95	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	364.62	406.99	453.26	492.61	476.84	371.27	258.11	267.37	357.36	373.49	353.39	348.7	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1030.45	999.11	908.41	763.95	593.09	400.01	263.8	276.79	429.21	642.69	850.67	1026.71	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	495.38	397.9	338.63	195.37	86.49	0	0	0	0	200.28	358.04	504.44	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2576.54 (98)

Space heating requirement in kWh/m²/year 51.02 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	495.38	397.9	338.63	195.37	86.49	0	0	0	0	200.28	358.04	504.44	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	529.82	425.57	362.17	208.95	92.51	0	0	0	0	214.21	382.93	539.51	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2755.65 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

168.43	148.65	156.56	140.96	138.58	124.47	120.15	131	130.51	146.14	153.75	164.59

Efficiency of water heater 79.8 (216)

(217)m=	87.52	87.32	86.82	85.68	83.6	79.8	79.8	79.8	79.8	85.66	87	87.61	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	192.45	170.24	180.32	164.51	165.77	155.98	150.56	164.16	163.54	170.61	176.73	187.87

Total = Sum(219a)$_{1...12}$ = 2042.74 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2755.65	
Water heating fuel used		2042.74	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.6	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	595.22	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	441.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1036.45	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	121.76	(268)
Total CO2, kg/year			sum of (265)…(271) =		1197.14	(272)

TER = 23.71 (273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-2-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.98	(1a) x	2.4	(2a) =	172.75	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.98	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	172.75	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 2			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Floor			71.98	x	0.11	=	7.9178			(28)
Walls Type1	41.71	17.94	23.77	x	0.18	=	4.28			(29)
Walls Type2	11.24	2.1	9.14	x	0.18	=	1.65			(29)
Total area of elements, m²			124.93							(31)
Party wall			43.65	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 36.9 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.75 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 51.65 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	80.15	80.15	80.15	80.15	80.15	80.15	80.15	80.15	80.15	80.15	80.15	80.15	

Average = $Sum(39)_{1...12}$ /12= 80.15 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	

Average = $Sum(40)_{1...12}$ /12= 1.11 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.29 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.66 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.53	93.98	90.44	86.89	83.34	79.8	79.8	83.34	86.89	90.44	93.98	97.53	

Total = $Sum(44)_{1...12}$ = 1063.97 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.63	126.5	130.54	113.8	109.2	94.23	87.32	100.2	101.39	118.17	128.99	140.07	

Total = $Sum(45)_{1...12}$ = 1395.03 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.7	18.97	19.58	17.07	16.38	14.13	13.1	15.03	15.21	17.72	19.35	21.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.91	176.43	185.81	167.3	164.47	147.72	142.59	155.47	154.89	173.44	182.48	195.35	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.91	176.43	185.81	167.3	164.47	147.72	142.59	155.47	154.89	173.44	182.48	195.35

Output from water heater (annual)$_{1...12}$ | 2045.87 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.31	82	87.62	80.63	80.53	74.13	73.25	77.54	76.51	83.51	85.68	90.8	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18	15.98	13	9.84	7.36	6.21	6.71	8.72	11.71	14.87	17.35	18.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	201.87	203.97	198.69	187.45	173.27	159.93	151.03	148.93	154.21	165.45	179.63	192.97	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	(71)

Water heating gains (Table 5)

(72)m=	124.08	122.03	117.77	111.99	108.24	102.95	98.46	104.22	106.26	112.25	119	122.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	401.34	399.38	386.86	366.68	346.26	326.49	313.59	319.27	329.58	349.96	373.39	390.9	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)

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North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
East	0.9x	1	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(76)
East	0.9x	1	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(76)
East	0.9x	1	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(76)
East	0.9x	1	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(76)
East	0.9x	1	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(76)
East	0.9x	1	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(76)
East	0.9x	1	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(76)
East	0.9x	1	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(76)
East	0.9x	1	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(76)
East	0.9x	1	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(76)
East	0.9x	1	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(76)
East	0.9x	1	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	66.09	127.6	213.87	329.81	427.83	450.24	423.48	346.58	253.49	151.67	81.91	54.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	467.43	526.98	600.73	696.49	774.09	776.73	737.08	665.85	583.07	501.63	455.3	445.67	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.82	0.63	0.47	0.54	0.81	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.85	19.99	20.25	20.59	20.86	20.97	20.99	20.99	20.9	20.54	20.13	19.82	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.77	0.54	0.37	0.43	0.74	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.47	18.67	19.04	19.51	19.85	19.97	19.99	19.99	19.91	19.46	18.87	18.41	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.02	19.2	19.52	19.94	20.26	20.37	20.39	20.39	20.3	19.9	19.37	18.97	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.02	19.2	19.52	19.94	20.26	20.37	20.39	20.39	20.3	19.9	19.37	18.97	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.92	0.78	0.58	0.41	0.47	0.76	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	465.04	521.76	585.47	640.6	606.07	449.11	301.97	315.77	445.77	478.29	450.66	443.86	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1179.97	1146.08	1043.9	885.14	685.73	462.58	303.82	319.58	497.34	745.09	983.88	1184.03	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	531.91	419.55	341.08	176.07	59.27	0	0	0	0	198.5	383.92	550.69	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 2660.98 (98)

Space heating requirement in kWh/m²/year 36.97 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2660.98	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2794.03	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2045.87	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2148.16	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	49.42	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.58	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			46.58	(331)
Energy for lighting (calculated in Appendix L)				317.84	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	= 1147.86	(367)
Electrical energy for heat distribution	[(313) x		0.52	= 25.65	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			= 1173.51	(373)
CO2 associated with space heating (secondary)	(309) x		0	= 0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	= 0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1173.51	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	= 24.17	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	= 164.96	(379)
Total CO2, kg/year	sum of (376)…(382) =			1362.64	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.93	(384)
EI rating (section 14)				84.39	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.8

Property Address: b2-2-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.98	(1a) x	2.4	(2a) =	172.75	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.98	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	172.75	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.69	x1/[1/(1.4)+ 0.04]		=	6.22			(27)
Windows Type 2			4.69	x1/[1/(1.4)+ 0.04]		=	6.22			(27)
Windows Type 3			2.45	x1/[1/(1.4)+ 0.04]		=	3.25			(27)
Windows Type 4			2.45	x1/[1/(1.4)+ 0.04]		=	3.25			(27)
Windows Type 5			1.63	x1/[1/(1.4)+ 0.04]		=	2.16			(27)
Floor			71.98	x	0.13	=	9.3574			(28)
Walls Type1	41.71	15.91	25.8	x	0.18	=	4.64			(29)
Walls Type2	11.24	2.1	9.14	x	0.18	=	1.65			(29)
Total area of elements, m²			124.93							(31)
Party wall			43.65	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.84 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.16 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 51 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.51	34.28	34.05	32.98	32.78	31.84	31.84	31.67	32.2	32.78	33.18	33.61	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	85.51	85.27	85.05	83.97	83.77	82.84	82.84	82.66	83.2	83.77	84.18	84.6	

Average = Sum(39)$_{1...12}$ /12= 83.97 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.19	1.18	1.18	1.17	1.16	1.15	1.15	1.15	1.16	1.16	1.17	1.18	

Average = Sum(40)$_{1...12}$ /12= 1.17 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.29 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.66 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.53	93.98	90.44	86.89	83.34	79.8	79.8	83.34	86.89	90.44	93.98	97.53	

Total = Sum(44)$_{1...12}$ = 1063.97 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.63	126.5	130.54	113.8	109.2	94.23	87.32	100.2	101.39	118.17	128.99	140.07	

Total = Sum(45)$_{1...12}$ = 1395.03 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.7	18.97	19.58	17.07	16.38	14.13	13.1	15.03	15.21	17.72	19.35	21.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.23	168.58	177.13	158.9	155.79	139.32	133.91	146.79	146.49	164.76	174.08	186.67	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.23	168.58	177.13	158.9	155.79	139.32	133.91	146.79	146.49	164.76	174.08	186.67

Output from water heater (annual)1…12 | 1943.65 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.37	75.73	80.68	73.91	73.58	67.4	66.31	70.59	69.79	76.57	78.96	83.85	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18	15.99	13	9.84	7.36	6.21	6.71	8.73	11.71	14.87	17.36	18.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	201.87	203.97	198.69	187.45	173.27	159.93	151.03	148.93	154.21	165.45	179.63	192.97	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	(71)

Water heating gains (Table 5)

(72)m=	114.74	112.69	108.44	102.66	98.9	93.62	89.12	94.88	96.93	102.91	109.67	112.7	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	395.01	393.05	380.53	360.35	339.93	320.16	307.26	312.93	323.24	343.63	367.06	384.57	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	4.69	x	10.63	x	0.63	x	0.7	=	15.24	(74)
North	0.9x	0.77	x	2.45	x	10.63	x	0.63	x	0.7	=	7.96	(74)
North	0.9x	0.77	x	2.45	x	10.63	x	0.63	x	0.7	=	7.96	(74)
North	0.9x	0.77	x	1.63	x	10.63	x	0.63	x	0.7	=	5.3	(74)
North	0.9x	0.77	x	4.69	x	20.32	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.45	x	20.32	x	0.63	x	0.7	=	15.22	(74)
North	0.9x	0.77	x	2.45	x	20.32	x	0.63	x	0.7	=	15.22	(74)
North	0.9x	0.77	x	1.63	x	20.32	x	0.63	x	0.7	=	10.12	(74)
North	0.9x	0.77	x	4.69	x	34.53	x	0.63	x	0.7	=	49.49	(74)
North	0.9x	0.77	x	2.45	x	34.53	x	0.63	x	0.7	=	25.85	(74)
North	0.9x	0.77	x	2.45	x	34.53	x	0.63	x	0.7	=	25.85	(74)
North	0.9x	0.77	x	1.63	x	34.53	x	0.63	x	0.7	=	17.2	(74)
North	0.9x	0.77	x	4.69	x	55.46	x	0.63	x	0.7	=	79.5	(74)
North	0.9x	0.77	x	2.45	x	55.46	x	0.63	x	0.7	=	41.53	(74)
North	0.9x	0.77	x	2.45	x	55.46	x	0.63	x	0.7	=	41.53	(74)
North	0.9x	0.77	x	1.63	x	55.46	x	0.63	x	0.7	=	27.63	(74)
North	0.9x	0.77	x	4.69	x	74.72	x	0.63	x	0.7	=	107.09	(74)
North	0.9x	0.77	x	2.45	x	74.72	x	0.63	x	0.7	=	55.94	(74)
North	0.9x	0.77	x	2.45	x	74.72	x	0.63	x	0.7	=	55.94	(74)
North	0.9x	0.77	x	1.63	x	74.72	x	0.63	x	0.7	=	37.22	(74)
North	0.9x	0.77	x	4.69	x	79.99	x	0.63	x	0.7	=	114.65	(74)
North	0.9x	0.77	x	2.45	x	79.99	x	0.63	x	0.7	=	59.89	(74)
North	0.9x	0.77	x	2.45	x	79.99	x	0.63	x	0.7	=	59.89	(74)
North	0.9x	0.77	x	1.63	x	79.99	x	0.63	x	0.7	=	39.84	(74)
North	0.9x	0.77	x	4.69	x	74.68	x	0.63	x	0.7	=	107.04	(74)
North	0.9x	0.77	x	2.45	x	74.68	x	0.63	x	0.7	=	55.91	(74)
North	0.9x	0.77	x	2.45	x	74.68	x	0.63	x	0.7	=	55.91	(74)
North	0.9x	0.77	x	1.63	x	74.68	x	0.63	x	0.7	=	37.2	(74)
North	0.9x	0.77	x	4.69	x	59.25	x	0.63	x	0.7	=	84.92	(74)
North	0.9x	0.77	x	2.45	x	59.25	x	0.63	x	0.7	=	44.36	(74)
North	0.9x	0.77	x	2.45	x	59.25	x	0.63	x	0.7	=	44.36	(74)
North	0.9x	0.77	x	1.63	x	59.25	x	0.63	x	0.7	=	29.51	(74)
North	0.9x	0.77	x	4.69	x	41.52	x	0.63	x	0.7	=	59.51	(74)
North	0.9x	0.77	x	2.45	x	41.52	x	0.63	x	0.7	=	31.09	(74)
North	0.9x	0.77	x	2.45	x	41.52	x	0.63	x	0.7	=	31.09	(74)
North	0.9x	0.77	x	1.63	x	41.52	x	0.63	x	0.7	=	20.68	(74)
North	0.9x	0.77	x	4.69	x	24.19	x	0.63	x	0.7	=	34.67	(74)
North	0.9x	0.77	x	2.45	x	24.19	x	0.63	x	0.7	=	18.11	(74)
North	0.9x	0.77	x	2.45	x	24.19	x	0.63	x	0.7	=	18.11	(74)
North	0.9x	0.77	x	1.63	x	24.19	x	0.63	x	0.7	=	12.05	(74)
North	0.9x	0.77	x	4.69	x	13.12	x	0.63	x	0.7	=	18.8	(74)

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North	0.9x	0.77	x	2.45	x	13.12	x	0.63	x	0.7	=	9.82	(74)
North	0.9x	0.77	x	2.45	x	13.12	x	0.63	x	0.7	=	9.82	(74)
North	0.9x	0.77	x	1.63	x	13.12	x	0.63	x	0.7	=	6.53	(74)
North	0.9x	0.77	x	4.69	x	8.86	x	0.63	x	0.7	=	12.71	(74)
North	0.9x	0.77	x	2.45	x	8.86	x	0.63	x	0.7	=	6.64	(74)
North	0.9x	0.77	x	2.45	x	8.86	x	0.63	x	0.7	=	6.64	(74)
North	0.9x	0.77	x	1.63	x	8.86	x	0.63	x	0.7	=	4.42	(74)
East	0.9x	1	x	4.69	x	19.64	x	0.63	x	0.7	=	28.15	(76)
East	0.9x	1	x	4.69	x	38.42	x	0.63	x	0.7	=	55.07	(76)
East	0.9x	1	x	4.69	x	63.27	x	0.63	x	0.7	=	90.69	(76)
East	0.9x	1	x	4.69	x	92.28	x	0.63	x	0.7	=	132.27	(76)
East	0.9x	1	x	4.69	x	113.09	x	0.63	x	0.7	=	162.1	(76)
East	0.9x	1	x	4.69	x	115.77	x	0.63	x	0.7	=	165.94	(76)
East	0.9x	1	x	4.69	x	110.22	x	0.63	x	0.7	=	157.98	(76)
East	0.9x	1	x	4.69	x	94.68	x	0.63	x	0.7	=	135.7	(76)
East	0.9x	1	x	4.69	x	73.59	x	0.63	x	0.7	=	105.48	(76)
East	0.9x	1	x	4.69	x	45.59	x	0.63	x	0.7	=	65.34	(76)
East	0.9x	1	x	4.69	x	24.49	x	0.63	x	0.7	=	35.1	(76)
East	0.9x	1	x	4.69	x	16.15	x	0.63	x	0.7	=	23.15	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	64.61	124.75	209.09	322.45	418.3	440.2	414.04	338.86	247.84	148.29	80.08	53.55	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	459.63	517.8	589.62	682.8	758.22	760.37	721.3	651.79	571.08	491.92	447.14	438.11	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.95	0.84	0.66	0.5	0.57	0.84	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.74	19.89	20.15	20.52	20.82	20.96	20.99	20.99	20.87	20.49	20.06	19.72	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.93	19.93	19.95	19.95	19.96	19.96	19.96	19.96	19.95	19.94	19.94	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.79	0.57	0.38	0.45	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.26	18.47	18.86	19.39	19.78	19.93	19.96	19.96	19.86	19.36	18.73	18.24	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.85	19.04	19.38	19.84	20.19	20.35	20.37	20.37	20.26	19.81	19.26	18.83	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.85	19.04	19.38	19.84	20.19	20.35	20.37	20.37	20.26	19.81	19.26	18.83	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.81	0.6	0.43	0.5	0.79	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	457.41	513.1	576.34	634.48	610.49	457.94	309.7	322.75	448.62	471.56	442.96	436.43	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1244.56	1205.76	1095.34	918.94	711.49	475.93	312.37	327.98	512.7	771.54	1023.7	1237.85	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	585.64	465.47	386.14	204.81	75.14	0	0	0	0	223.18	418.13	596.26	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2954.76 (98)

Space heating requirement in kWh/m²/year 41.05 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	585.64	465.47	386.14	204.81	75.14	0	0	0	0	223.18	418.13	596.26	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	626.35	497.83	412.98	219.05	80.36	0	0	0	0	238.7	447.2	637.71	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3160.17 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)													
	191.23	168.58	177.13	158.9	155.79	139.32	133.91	146.79	146.49	164.76	174.08	186.67	
Efficiency of water heater												79.8	(216)
(217)m=	87.61	87.38	86.84	85.49	82.99	79.8	79.8	79.8	79.8	85.62	87.07	87.7	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	218.28	192.92	203.98	185.86	187.72	174.59	167.81	183.95	183.57	192.42	199.93	212.85	

Total = Sum(219a)$_{1...12}$ = 2303.88 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3160.17

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Water heating fuel used			2303.88	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			317.9	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	682.6	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	497.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1180.23	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	164.99	(268)
Total CO2, kg/year		sum of (265)…(271) =		1384.15	(272)
TER =				19.23	(273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-2-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.81	(1a) x	2.4	(2a) =	121.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.81	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Floor			50.81	x	0.11	=	5.5891			(28)
Walls Type1	17.04	7.36	9.68	x	0.18	=	1.74			(29)
Walls Type2	19.18	2.1	17.08	x	0.18	=	3.07			(29)
Total area of elements, m²			87.03							(31)
Party wall			33.09	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 21.35 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.09 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 31.45 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	51.57	51.57	51.57	51.57	51.57	51.57	51.57	51.57	51.57	51.57	51.57	51.57	

Average = Sum(39)$_{1…12}$ /12= 51.57 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01

Average = Sum(40)$_{1…12}$ /12= 1.01 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.91 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.4	79.4	76.4	73.41	70.41	67.42	67.42	70.41	73.41	76.4	79.4	82.4	
										Total = Sum(44)$_{1…12}$ =		898.88	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	122.19	106.87	110.28	96.15	92.25	79.61	73.77	84.65	85.66	99.83	108.97	118.34	
										Total = Sum(45)$_{1…12}$ =		1178.57	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.33	16.03	16.54	14.42	13.84	11.94	11.07	12.7	12.85	14.97	16.35	17.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	177.47	156.8	165.56	149.64	147.53	133.1	129.05	139.93	139.16	155.11	162.47	173.61	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	177.47	156.8	165.56	149.64	147.53	133.1	129.05	139.93	139.16	155.11	162.47	173.61	

Output from water heater (annual)$_{1...12}$ 1829.41 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.85	75.48	80.89	74.76	74.9	69.26	68.75	72.37	71.28	77.42	79.03	83.57	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.8	12.26	9.97	7.55	5.64	4.76	5.15	6.69	8.98	11.4	13.3	14.18	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	149.34	150.89	146.98	138.67	128.17	118.31	111.72	110.17	114.08	122.39	132.89	142.75	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	(71)

Water heating gains (Table 5)

(72)m=	114.05	112.32	108.72	103.84	100.67	96.2	92.41	97.27	99	104.05	109.76	112.32	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	325.89	324.17	314.38	298.76	283.19	267.98	257.98	262.84	270.76	286.55	304.66	317.96	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)

East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	40.07	78.39	129.09	188.27	230.73	236.19	224.87	193.16	150.14	93.01	49.96	32.95	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	365.96	402.55	443.47	487.03	513.92	504.18	482.85	456	420.9	379.56	354.62	350.91	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.82	0.63	0.47	0.51	0.77	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.18	20.4	20.68	20.89	20.98	21	20.99	20.94	20.67	20.31	20.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.91	0.77	0.55	0.37	0.41	0.69	0.93	0.99	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.82	19	19.32	19.7	19.96	20.06	20.07	20.07	20.02	19.7	19.18	18.77	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.59	19.86	20.19	20.43	20.52	20.53	20.53	20.48	20.18	19.75	19.39	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.44	19.59	19.86	20.19	20.43	20.52	20.53	20.53	20.48	20.18	19.75	19.39	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.79	0.59	0.42	0.46	0.73	0.94	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	363.07	396.86	429.05	444.26	404	297.49	201.87	211.39	306.28	354.91	349.06	348.68	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	780.75	757.66	689.09	582.13	449.95	305.15	202.82	213.05	329.08	494.17	652.11	783.53	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	310.75	242.46	193.47	99.27	34.18	0	0	0	0	103.61	218.2	323.53	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1525.47 (98)

Space heating requirement in kWh/m²/year 30.02 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1525.47	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1601.74	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1829.41	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1920.89	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	35.23	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		32.88	(330a)

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warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =		32.88	(331)
Energy for lighting (calculated in Appendix L)			243.69	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)				
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	= 818.16	(367)
Electrical energy for heat distribution	[(313) x	0.52	= 18.28	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		= 836.44	(373)
CO2 associated with space heating (secondary)	(309) x	0	= 0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	= 0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		836.44	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	= 17.06	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	= 126.47	(379)
Total CO2, kg/year	sum of (376)…(382) =		979.98	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =		19.29	(384)
EI rating (section 14)			86.29	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b2-2-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.81	(1a) x	2.4	(2a) =	121.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.81	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Floor			50.81	x	0.13	=	6.6053			(28)
Walls Type1	17.04	7.36	9.68	x	0.18	=	1.74			(29)
Walls Type2	19.18	2.1	17.08	x	0.18	=	3.07			(29)
Total area of elements, m²			87.03							(31)
Party wall			33.09	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) — (26)…(30) + (32) = 23.28 (33)

Heat capacity Cm = S(A x k) — ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K — Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.32 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss — (33) + (36) = 31.6 (37)

Ventilation heat loss calculated monthly — (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	24.17	24.01	23.86	23.14	23	22.37	22.37	22.25	22.61	23	23.27	23.56	(38)

Heat transfer coefficient, W/K — (39)m = (37) + (38)m

(39)m=	55.77	55.61	55.46	54.74	54.6	53.97	53.97	53.85	54.21	54.6	54.87	55.16	

Average = Sum(39)$_{1…12}$ /12= 54.74 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.1	1.09	1.09	1.08	1.07	1.06	1.06	1.06	1.07	1.07	1.08	1.09

Average = Sum(40)$_{1...12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.91 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.4	79.4	76.4	73.41	70.41	67.42	67.42	70.41	73.41	76.4	79.4	82.4	
									Total = Sum(44)$_{1...12}$ =			898.88	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	122.19	106.87	110.28	96.15	92.25	79.61	73.77	84.65	85.66	99.83	108.97	118.34	
									Total = Sum(45)$_{1...12}$ =			1178.57	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.33	16.03	16.54	14.42	13.84	11.94	11.07	12.7	12.85	14.97	16.35	17.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.79	148.96	156.88	141.24	138.85	124.7	120.36	131.25	130.75	146.43	154.06	164.93	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.79	148.96	156.88	141.24	138.85	124.7	120.36	131.25	130.75	146.43	154.06	164.93	

Output from water heater (annual)$_{1...12}$ 1727.19 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.91	69.2	73.94	68.04	67.95	62.54	61.8	65.42	64.56	70.47	72.31	76.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.18	12.59	10.24	7.75	5.8	4.89	5.29	6.87	9.22	11.71	13.67	14.57	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	149.34	150.89	146.98	138.67	128.17	118.31	111.72	110.17	114.08	122.39	132.89	142.75	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	(71)

Water heating gains (Table 5)

(72)m=	104.71	102.98	99.39	94.5	91.33	86.87	83.07	87.93	89.66	94.72	100.43	102.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	319.94	318.17	308.32	292.63	277.01	261.78	251.79	256.69	264.67	280.53	298.69	312.02	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(76)

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East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	44.18	86.42	142.32	207.57	254.38	260.4	247.92	212.96	165.53	102.54	55.08	36.33	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	364.11	404.59	450.64	500.2	531.39	522.18	499.7	469.64	430.2	383.07	353.77	348.35	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.82	0.64	0.47	0.52	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.94	20.08	20.32	20.63	20.87	20.97	21	20.99	20.93	20.62	20.23	19.92	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20.01	20.01	20.02	20.02	20.03	20.03	20.03	20.03	20.02	20.02	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.91	0.77	0.55	0.37	0.41	0.7	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.6	18.8	19.16	19.6	19.9	20.02	20.03	20.03	19.97	19.59	19.03	18.57	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.27	19.44	19.74	20.12	20.38	20.49	20.51	20.51	20.45	20.11	19.63	19.24	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.27	19.44	19.74	20.12	20.38	20.49	20.51	20.51	20.45	20.11	19.63	19.24	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.99	0.97	0.91	0.79	0.59	0.42	0.47	0.74	0.94	0.99	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	361.39	399.11	436.49	457.03	419.68	309.02	209.97	219.35	316.56	359.63	348.58	346.24		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	834.81	808.6	734.2	613.98	474.02	318.14	211.19	221.44	344.21	519.17	687.56	829.87		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	352.22	275.18	221.49	113	40.42	0	0	0	0	118.7	244.07	359.82		
									Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =				1724.91	(98)
Space heating requirement in kWh/m²/year													33.95	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	352.22	275.18	221.49	113	40.42	0	0	0	0	118.7	244.07	359.82		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	376.71	294.31	236.89	120.86	43.23	0	0	0	0	126.95	261.04	384.83		
									Total (kWh/year) =Sum(211)$_{1...5,10....12}$=				1844.82	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
									Total (kWh/year) =Sum(215)$_{1...5,10....12}$=				0	(215)

Water heating

Output from water heater (calculated above)														
	168.79	148.96	156.88	141.24	138.85	124.7	120.36	131.25	130.75	146.43	154.06	164.93		
Efficiency of water heater													79.8	(216)
(217)m=	86.73	86.43	85.73	84.23	81.99	79.8	79.8	79.8	79.8	84.26	86.04	86.84		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	194.61	172.34	182.98	167.69	169.36	156.27	150.83	164.47	163.85	173.78	179.07	189.93		
									Total = Sum(219a)$_{1...12}$ =				2065.17	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1844.82

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Water heating fuel used			2065.17	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			250.39	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	398.48	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	446.08	(264)
Space and water heating	(261) + (262) + (263) + (264) =			844.56	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	129.95	(268)
Total CO2, kg/year		sum of (265)…(271) =		1013.44	(272)

TER = 19.95 (273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-2-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.09	(1a) x	2.4	(2a) =	177.82	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.09	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	177.82	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Floor			74.09	x	0.11	=	8.149899			(28)
Walls Type1	31	12.88	18.12	x	0.18	=	3.26			(29)
Walls Type2	31.26	2.1	29.16	x	0.18	=	5.25			(29)
Total area of elements, m²			136.35							(31)
Party wall			31.88	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.93 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.14 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 48.06 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	

Average = Sum(39)$_{1…12}$ /12= 77.4 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	

Average = Sum(40)$_{1…12}$ /12= 1.04 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.34 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.8 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	98.78	95.19	91.6	88.01	84.42	80.82	80.82	84.42	88.01	91.6	95.19	98.78	

Total = Sum(44)$_{1…12}$ = 1077.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.49	128.12	132.21	115.27	110.6	95.44	88.44	101.49	102.7	119.68	130.64	141.87	

Total = Sum(45)$_{1…12}$ = 1412.96 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.97	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.4	17.95	19.6	21.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.77	178.05	187.49	168.76	165.88	148.93	143.72	156.76	156.19	174.96	184.14	197.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.77	178.05	187.49	168.76	165.88	148.93	143.72	156.76	156.19	174.96	184.14	197.15

Output from water heater (annual)$_{1...12}$	2063.8	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.93	82.54	88.18	81.12	81	74.53	73.63	77.97	76.94	84.02	86.23	91.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.57	16.49	13.41	10.15	7.59	6.41	6.92	9	12.08	15.34	17.9	19.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	206.65	208.79	203.39	191.89	177.36	163.72	154.6	152.45	157.86	169.36	183.88	197.53	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	(71)

Water heating gains (Table 5)

(72)m=	124.91	122.83	118.52	112.67	108.87	103.51	98.96	104.79	106.86	112.93	119.77	122.84	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	408.24	406.23	393.44	372.82	351.94	331.75	318.6	324.36	334.92	355.74	379.67	397.57	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.6	x	10.63	x	0.5	x	0.8	=	13.56	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.5	x	0.8	=	25.91	(74)

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North	0.9x	0.77	x	4.6	x	34.53	x	0.5	x	0.8	=	44.03	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.5	x	0.8	=	70.72	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.5	x	0.8	=	95.27	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.5	x	0.8	=	101.99	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.5	x	0.8	=	95.22	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.5	x	0.8	=	75.55	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.5	x	0.8	=	52.94	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.5	x	0.8	=	30.84	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.5	x	0.8	=	16.73	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.5	x	0.8	=	11.3	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)

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East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	58.64	114.1	189.26	282.53	354.84	367.71	348.2	292.85	221.84	135.48	72.93	48.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	466.88	520.33	582.7	655.35	706.78	699.46	666.8	617.21	556.76	491.22	452.6	445.95	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.95	0.85	0.67	0.5	0.56	0.83	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.06	20.29	20.6	20.85	20.97	20.99	20.99	20.9	20.58	20.19	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.8	0.59	0.4	0.45	0.75	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.62	18.81	19.14	19.57	19.9	20.03	20.04	20.04	19.97	19.55	19	18.57	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.14	19.31	19.6	19.98	20.28	20.4	20.42	20.42	20.34	19.96	19.48	19.1	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.14	19.31	19.6	19.98	20.28	20.4	20.42	20.42	20.34	19.96	19.48	19.1	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.82	0.62	0.44	0.5	0.78	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	464.79	515.88	570.12	611.8	577.45	433.74	294	307.47	433.81	470.37	448.5	444.37	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1149.03	1115.14	1014.24	857.8	664.04	449.12	296.01	311.26	483.31	724.75	957.99	1153.15	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	509.08	402.7	330.43	177.13	64.42	0	0	0	0	189.26	366.83	527.33	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2567.17 (98)

Space heating requirement in kWh/m²/year 34.65 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2567.17	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2695.53	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2063.8	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2166.99	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	48.63	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.94	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	47.94	(331)
Energy for lighting (calculated in Appendix L)		327.88	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1129.36	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	25.24	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1154.6	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1154.6	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	24.88	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	170.17	(379)
Total CO2, kg/year	sum of (376)…(382) =			1349.65	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.22	(384)
EI rating (section 14)				84.81	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-2-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.09	(1a) x	2.4	(2a) =	177.82	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.09	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	177.82	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Floor			74.09	x	0.13	=	9.6317			(28)
Walls Type1	31	12.88	18.12	x	0.18	=	3.26			(29)
Walls Type2	31.26	2.1	29.16	x	0.18	=	5.25			(29)
Total area of elements, m²			136.35							(31)
Party wall			31.88	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.21 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 49.53 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	35.38	35.15	34.92	33.84	33.63	32.69	32.69	32.52	33.06	33.63	34.04	34.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	84.91	84.68	84.45	83.37	83.17	82.23	82.23	82.05	82.59	83.17	83.58	84	

Average = Sum(39)$_{1...12}$ /12= 83.37 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.15	1.14	1.14	1.13	1.12	1.11	1.11	1.11	1.11	1.12	1.13	1.13

Average = Sum(40)$_{1...12}$ /12= 1.13 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.34 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.8 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	98.78	95.19	91.6	88.01	84.42	80.82	80.82	84.42	88.01	91.6	95.19	98.78

Total = Sum(44)$_{1...12}$ = 1077.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.49	128.12	132.21	115.27	110.6	95.44	88.44	101.49	102.7	119.68	130.64	141.87

Total = Sum(45)$_{1...12}$ = 1412.96 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.97	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.4	17.95	19.6	21.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	193.09	170.21	178.81	160.36	157.2	140.53	135.03	148.08	147.79	166.28	175.74	188.47	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	193.09	170.21	178.81	160.36	157.2	140.53	135.03	148.08	147.79	166.28	175.74	188.47	

Output from water heater (annual)$_{1...12}$ | 1961.57 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.98	76.27	81.24	74.4	74.05	67.81	66.68	71.02	70.22	77.07	79.51	84.45	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.93	16.81	13.67	10.35	7.74	6.53	7.06	9.17	12.31	15.63	18.25	19.45	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	206.65	208.79	203.39	191.89	177.36	163.72	154.6	152.45	157.86	169.36	183.88	197.53	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	(71)

Water heating gains (Table 5)

(72)m=	115.57	113.5	109.19	103.33	99.53	94.18	89.63	95.46	97.53	103.59	110.43	113.51	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	402.26	400.22	387.37	366.69	345.75	325.54	312.4	318.2	328.82	349.7	373.68	391.61	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.6	x	10.63	x	0.63	x	0.7	=	14.95	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.63	x	0.7	=	28.57	(74)

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North	0.9x	0.77	x	4.6	x	34.53	x	0.63	x	0.7	=	48.54	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.63	x	0.7	=	77.97	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.63	x	0.7	=	105.04	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.63	x	0.7	=	112.44	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.63	x	0.7	=	104.98	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.63	x	0.7	=	83.29	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.63	x	0.7	=	58.36	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.63	x	0.7	=	34.01	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.63	x	0.7	=	18.44	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.63	x	0.7	=	12.46	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)

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East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	64.65	125.79	208.65	311.49	391.22	405.4	383.89	322.86	244.58	149.37	80.41	53.33	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	466.91	526.01	596.02	678.17	736.96	730.94	696.29	641.07	573.4	499.07	454.09	444.94	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.95	0.86	0.68	0.51	0.57	0.83	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.79	19.93	20.19	20.54	20.82	20.96	20.99	20.99	20.88	20.52	20.1	19.77	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.96	19.97	19.97	19.98	19.98	19.99	19.99	19.99	19.99	19.98	19.98	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.81	0.59	0.4	0.46	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.36	18.57	18.94	19.44	19.81	19.97	19.99	19.99	19.9	19.42	18.81	18.33	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.93	19.11	19.44	19.88	20.21	20.36	20.39	20.39	20.29	19.86	19.33	18.91	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.93	19.11	19.44	19.88	20.21	20.36	20.39	20.39	20.29	19.86	19.33	18.91	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.82	0.62	0.44	0.5	0.79	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	464.8	521.45	583.1	633.06	603.89	454.93	309	322.26	450.7	478.61	450.04	443.35	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1242.37	1203.54	1092.88	915.37	707.9	473.99	311.72	327.25	511.32	770.11	1021.79	1235.49	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	578.51	458.36	379.27	203.27	77.38	0	0	0	0	216.87	411.66	589.35	

Total per year (kWh/year) = $\text{Sum}(98)_{1...5,9...12}$ = 2914.67 (98)

Space heating requirement in kWh/m²/year 39.34 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system			0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =		1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =		1	(204)
Efficiency of main space heating system 1			93.5	(206)
Efficiency of secondary/supplementary heating system, %			0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	578.51	458.36	379.27	203.27	77.38	0	0	0	0	216.87	411.66	589.35		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	618.73	490.23	405.64	217.4	82.76	0	0	0	0	231.95	440.28	630.32		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3117.3	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	193.09	170.21	178.81	160.36	157.2	140.53	135.03	148.08	147.79	166.28	175.74	188.47		
Efficiency of water heater													79.8	(216)
(217)m=	87.56	87.33	86.77	85.45	83.04	79.8	79.8	79.8	79.8	85.52	87.01	87.65		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	220.52	194.91	206.07	187.67	189.3	176.1	169.22	185.56	185.2	194.42	201.97	215.02		
Total = Sum(219a)$_{1...12}$ =													2325.96	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3117.3	
Water heating fuel used			2325.96	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			334.23	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	673.34	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	502.41	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1175.74	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	173.47	(268)
Total CO2, kg/year		sum of (265)…(271) =		1388.14	(272)

TER =	18.74	(273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-2-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	75.18	(1a) x	2.4	(2a) =	180.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.18	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	180.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Floor			75.18	x	0.11	=	8.2698			(28)
Walls Type1	41.41	15.41	26	x	0.18	=	4.68			(29)
Walls Type2	4.86	2.1	2.76	x	0.18	=	0.5			(29)
Total area of elements, m²			121.45							(31)
Party wall			42	x	0	=	0			(32)

* *for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

** *include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	33.61	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		13.52	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	47.13	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	

Average = $Sum(39)_{1...12}$ /12= 76.9 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	

Average = $Sum(40)_{1...12}$ /12= 1.02 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.37 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.37 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	99.41	95.79	92.18	88.56	84.95	81.33	81.33	84.95	88.56	92.18	95.79	99.41	

Total = $Sum(44)_{1...12}$ = 1084.44 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.42	128.93	133.05	115.99	111.3	96.04	89	102.13	103.35	120.44	131.47	142.77	

Total = $Sum(45)_{1...12}$ = 1421.87 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.11	19.34	19.96	17.4	16.69	14.41	13.35	15.32	15.5	18.07	19.72	21.41	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.69	178.86	188.32	169.49	166.58	149.54	144.27	157.4	156.84	175.72	184.96	198.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.69	178.86	188.32	169.49	166.58	149.54	144.27	157.4	156.84	175.72	184.96	198.04

Output from water heater (annual)$_{1...12}$	2072.71	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.24	82.81	88.46	81.36	81.23	74.73	73.81	78.18	77.16	84.27	86.51	91.69	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.64	16.56	13.46	10.19	7.62	6.43	6.95	9.03	12.13	15.4	17.97	19.16	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	209.07	211.24	205.78	194.14	179.44	165.64	156.41	154.24	159.71	171.35	186.04	199.85	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	(71)

Water heating gains (Table 5)

(72)m=	125.32	123.23	118.9	113	109.18	103.79	99.21	105.08	107.16	113.26	120.15	123.24	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.51	409.51	396.61	375.81	354.72	334.33	321.05	326.83	337.47	358.48	382.64	400.72	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(76)
East	0.9x	1	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(76)

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East	0.9x	1	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(76)
East	0.9x	1	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(76)
East	0.9x	1	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(76)
East	0.9x	1	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(76)
East	0.9x	1	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(76)
East	0.9x	1	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(76)
East	0.9x	1	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(76)
East	0.9x	1	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(76)
East	0.9x	1	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(76)
East	0.9x	1	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)

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South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	159.95	271.13	366.39	444.56	488.08	479.88	464.62	433.09	393.73	298.53	191.37	137.01	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	571.46	680.64	763	820.36	842.8	814.22	785.67	759.92	731.2	657.01	574.01	537.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.89	0.77	0.59	0.43	0.46	0.69	0.92	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.08	20.27	20.51	20.75	20.92	20.98	21	21	20.96	20.75	20.36	20.03	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.87	0.71	0.51	0.34	0.37	0.61	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.86	19.13	19.46	19.79	19.99	20.05	20.06	20.06	20.04	19.79	19.25	18.78	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.59	19.88	20.17	20.36	20.43	20.44	20.44	20.41	20.17	19.69	19.28	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.59	19.88	20.17	20.36	20.43	20.44	20.44	20.41	20.17	19.69	19.28	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.87	0.73	0.54	0.37	0.41	0.64	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	565.54	663.53	718.96	712.94	617.41	440.45	294.25	309.08	466.98	585.14	560.57	533.58	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1157.07	1129.28	1028.93	866.73	665.81	448.03	295.07	310.39	485.14	736.25	968.34	1159.73	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	440.1	312.98	230.61	110.73	36.01	0	0	0	0	112.43	293.59	465.85	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = | 2002.32 | (98)

Space heating requirement in kWh/m²/year | 26.63 | (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2002.32	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2102.43	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2072.71	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2176.35	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	42.79	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		48.65	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	48.65	(331)
Energy for lighting (calculated in Appendix L)		329.17	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	993.78	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	22.21	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1015.99	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1015.99	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	25.25	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	170.84	(379)
Total CO2, kg/year	sum of (376)…(382) =			1212.08	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.12	(384)
EI rating (section 14)				86.49	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-2-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	75.18	(1a) x	2.4	(2a) =	180.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.18	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		180.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Floor			75.18	x	0.13	=	9.773399			(28)
Walls Type1	41.41	15.41	26	x	0.18	=	4.68			(29)
Walls Type2	4.86	2.1	2.76	x	0.18	=	0.5			(29)
Total area of elements, m²			121.45							(31)
Party wall			42	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.48 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.45 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 47.93 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	35.83	35.6	35.36	34.28	34.08	33.14	33.14	32.96	33.5	34.08	34.49	34.92	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	83.76	83.53	83.3	82.22	82.01	81.07	81.07	80.89	81.43	82.01	82.42	82.85	

Average = Sum(39)$_{1...12}$ /12= 82.21 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.11	1.11	1.11	1.09	1.09	1.08	1.08	1.08	1.08	1.09	1.1	1.1	

Average = Sum(40)$_{1...12}$ /12= 1.09 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.37 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.37 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	99.41	95.79	92.18	88.56	84.95	81.33	81.33	84.95	88.56	92.18	95.79	99.41	

Total = Sum(44)$_{1...12}$ = 1084.44 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.42	128.93	133.05	115.99	111.3	96.04	89	102.13	103.35	120.44	131.47	142.77	

Total = Sum(45)$_{1...12}$ = 1421.87 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.11	19.34	19.96	17.4	16.69	14.41	13.35	15.32	15.5	18.07	19.72	21.41	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	194.01	171.02	179.64	161.09	157.89	141.13	135.59	148.72	148.44	167.03	176.56	189.36	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	194.01	171.02	179.64	161.09	157.89	141.13	135.59	148.72	148.44	167.03	176.56	189.36	

Output from water heater (annual)$_{1...12}$ | 1970.49 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.29	76.54	81.51	74.64	74.28	68.01	66.87	71.23	70.44	77.32	79.79	84.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.73	16.63	13.53	10.24	7.65	6.46	6.98	9.08	12.18	15.47	18.05	19.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	209.07	211.24	205.78	194.14	179.44	165.64	156.41	154.24	159.71	171.35	186.04	199.85	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	(71)

Water heating gains (Table 5)

(72)m=	115.98	113.9	109.56	103.67	99.84	94.45	89.88	95.74	97.83	103.93	110.81	113.91	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	405.26	403.25	390.34	369.52	348.42	328.03	314.75	320.54	331.2	352.22	376.39	394.48	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.29	x	19.64	x	0.63	x	0.7	=	31.75	(76)
East	0.9x	1	x	5.29	x	38.42	x	0.63	x	0.7	=	62.11	(76)

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East	0.9x	1	x	5.29	x	63.27	x	0.63	x	0.7	=	102.29	(76)
East	0.9x	1	x	5.29	x	92.28	x	0.63	x	0.7	=	149.19	(76)
East	0.9x	1	x	5.29	x	113.09	x	0.63	x	0.7	=	182.84	(76)
East	0.9x	1	x	5.29	x	115.77	x	0.63	x	0.7	=	187.17	(76)
East	0.9x	1	x	5.29	x	110.22	x	0.63	x	0.7	=	178.19	(76)
East	0.9x	1	x	5.29	x	94.68	x	0.63	x	0.7	=	153.06	(76)
East	0.9x	1	x	5.29	x	73.59	x	0.63	x	0.7	=	118.97	(76)
East	0.9x	1	x	5.29	x	45.59	x	0.63	x	0.7	=	73.7	(76)
East	0.9x	1	x	5.29	x	24.49	x	0.63	x	0.7	=	39.59	(76)
East	0.9x	1	x	5.29	x	16.15	x	0.63	x	0.7	=	26.11	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.63	x	0.7	=	65.72	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.63	x	0.7	=	107.64	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.63	x	0.7	=	137.12	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.63	x	0.7	=	154.97	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.63	x	0.7	=	161.49	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.63	x	0.7	=	155.41	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.63	x	0.7	=	151.85	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.63	x	0.7	=	147.46	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.63	x	0.7	=	143.23	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.63	x	0.7	=	116.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)

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South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.63	x	0.7	=	77.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.63	x	0.7	=	56.79	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	176.35	298.92	403.95	490.12	538.11	529.07	512.25	477.48	434.08	329.12	210.99	151.05	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	581.61	702.17	794.29	859.64	886.53	857.1	826.99	798.02	765.28	681.34	587.37	545.53	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.89	0.77	0.59	0.43	0.46	0.69	0.92	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.18	20.44	20.71	20.9	20.98	21	21	20.96	20.71	20.28	19.93	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.99	19.99	19.99	20.01	20.01	20.02	20.02	20.02	20.01	20.01	20	20	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.86	0.71	0.51	0.33	0.37	0.61	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.63	18.93	19.31	19.69	19.92	20.01	20.02	20.02	19.98	19.7	19.1	18.58	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.17	19.43	19.76	20.1	20.31	20.4	20.41	20.41	20.37	20.1	19.57	19.12	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.17	19.43	19.76	20.1	20.31	20.4	20.41	20.41	20.37	20.1	19.57	19.12	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.87	0.73	0.54	0.37	0.4	0.64	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	575.43	684.05	747.75	745.3	648.68	460.9	307.76	322.71	488.96	606.82	573.42	541.18	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1245.22	1213.77	1104.4	920.83	706.15	469.92	308.82	324.34	510.84	779.49	1028.2	1236.33	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	498.32	355.97	265.35	126.38	42.76	0	0	0	0	128.47	327.44	517.2	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 2261.89 (98)

Space heating requirement in kWh/m²/year 30.09 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	498.32	355.97	265.35	126.38	42.76	0	0	0	0	128.47	327.44	517.2		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	532.97	380.72	283.79	135.17	45.73	0	0	0	0	137.4	350.2	553.15		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2419.13	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	194.01	171.02	179.64	161.09	157.89	141.13	135.59	148.72	148.44	167.03	176.56	189.36		
Efficiency of water heater													79.8	(216)
(217)m=	87.22	86.73	85.85	84.18	81.86	79.8	79.8	79.8	79.8	84.12	86.44	87.36		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	222.43	197.19	209.24	191.37	192.88	176.86	169.91	186.37	186.01	198.56	204.26	216.76		
Total = Sum(219a)$_{1...12}$ =													2351.84	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2419.13	
Water heating fuel used			2351.84	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			330.71	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	522.53	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	508	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1030.53	(265)

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Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	171.64	(268)
Total CO2, kg/year			sum of (265)…(271) =		1241.09	(272)

TER =	16.51	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b2-2-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	76.86	(1a) x	2.4	(2a) =	184.46	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76.86	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.46	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			6.9	x1/[1/(1.2)+ 0.04]		=	7.9			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Floor			76.86	x	0.11	=	8.4546			(28)
Walls Type1	31.77	14.26	17.51	x	0.18	=	3.15			(29)
Walls Type2	23.59	2.1	21.49	x	0.18	=	3.87			(29)
Total area of elements, m²			132.22							(31)
Party wall			33.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 13.36 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 47.68 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.12	78.12	78.12	78.12	78.12	78.12	78.12	78.12	78.12	78.12	78.12	78.12	

Average = Sum(39)$_{1…12}$ /12= 78.12 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	

Average = Sum(40)$_{1…12}$ /12= 1.02 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.4 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.21 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	100.34	96.69	93.04	89.39	85.74	82.09	82.09	85.74	89.39	93.04	96.69	100.34	

Total = Sum(44)$_{1…12}$ = 1094.57 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	148.79	130.14	134.29	117.08	112.34	96.94	89.83	103.08	104.31	121.56	132.7	144.1	

Total = Sum(45)$_{1…12}$ = 1435.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.32	19.52	20.14	17.56	16.85	14.54	13.47	15.46	15.65	18.23	19.9	21.61	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	204.07	180.06	189.57	170.57	167.61	150.43	145.1	158.36	157.8	176.84	186.19	199.38	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	204.07	180.06	189.57	170.57	167.61	150.43	145.1	158.36	157.8	176.84	186.19	199.38

Output from water heater (annual)$_{1...12}$ | 2085.99 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.7	83.21	88.87	81.72	81.57	75.03	74.09	78.5	77.48	84.64	86.92	92.13	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.01	16.88	13.73	10.39	7.77	6.56	7.09	9.21	12.37	15.7	18.33	19.54	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	212.75	214.96	209.4	197.55	182.6	168.55	159.16	156.96	162.52	174.36	189.31	203.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35	35	35	35	35	35	35	35	35	35	35	35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	(71)

Water heating gains (Table 5)

(72)m=	125.93	123.83	119.45	113.5	109.64	104.2	99.58	105.5	107.61	113.77	120.72	123.84	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	416.7	414.68	401.59	380.46	359.02	338.32	324.84	330.68	341.5	362.84	387.37	405.75	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	6.9	x	46.75	x	0.5	x	0.8	=	89.42	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)

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South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	6.9	x	76.57	x	0.5	x	0.8	=	146.45	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	6.9	x	97.53	x	0.5	x	0.8	=	186.55	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	6.9	x	110.23	x	0.5	x	0.8	=	210.84	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	6.9	x	114.87	x	0.5	x	0.8	=	219.71	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	6.9	x	110.55	x	0.5	x	0.8	=	211.44	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	6.9	x	108.01	x	0.5	x	0.8	=	206.59	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	6.9	x	104.89	x	0.5	x	0.8	=	200.63	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	6.9	x	101.89	x	0.5	x	0.8	=	194.87	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	6.9	x	82.59	x	0.5	x	0.8	=	157.96	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	6.9	x	55.42	x	0.5	x	0.8	=	106	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	6.9	x	40.4	x	0.5	x	0.8	=	77.27	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)

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West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	164.06	273.48	359.33	422.01	452.71	440.98	428.65	406.82	381.09	298.15	195.39	141.14	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	580.77	688.16	760.91	802.47	811.73	779.3	753.49	737.5	722.59	660.98	582.76	546.88	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.91	0.8	0.62	0.45	0.48	0.7	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.27	20.5	20.73	20.9	20.98	21	21	20.96	20.74	20.36	20.04	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.88	0.74	0.54	0.36	0.39	0.62	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.87	19.13	19.45	19.77	19.98	20.06	20.07	20.07	20.04	19.79	19.26	18.79	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.36	19.59	19.87	20.15	20.35	20.43	20.44	20.44	20.41	20.17	19.7	19.29	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.36	19.59	19.87	20.15	20.35	20.43	20.44	20.44	20.41	20.17	19.7	19.29	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.88	0.76	0.57	0.4	0.43	0.65	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	574.87	671.48	720.25	708.73	617.1	445.28	298.88	313.9	472.49	591.3	569.39	542.74	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1176.1	1147.4	1044.37	878.86	675.43	455.12	299.97	315.52	492.85	747.85	984.19	1178.87	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	447.31	319.82	241.15	122.49	43.4	0	0	0	0	116.48	298.65	473.28	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 2062.58 | (98)

Space heating requirement in kWh/m²/year | 26.84 | (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2062.58	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2165.71	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2085.99	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2190.29	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.56	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		49.74	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	49.74	(331)
Energy for lighting (calculated in Appendix L)		335.67	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1011.71	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	22.61	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1034.32	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1034.32	(376)

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CO_2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	25.81	(378)
CO_2 associated with electricity for lighting	(332))) x	0.52	=	174.21	(379)
Total CO_2, kg/year	sum of (376)…(382) =			1234.35	(383)
Dwelling CO_2 Emission Rate	(383) ÷ (4) =			16.06	(384)
EI rating (section 14)				86.43	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b2-2-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	76.86	(1a) x	2.4	(2a) =	184.46	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76.86	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.46	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.32	0.35	0.38	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			6.9	x1/[1/(1.4)+ 0.04]		=	9.15			(27)
Windows Type 2			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Floor			76.86	x	0.13	=	9.991799			(28)
Walls Type1	31.77	14.26	17.51	x	0.18	=	3.15			(29)
Walls Type2	23.59	2.1	21.49	x	0.18	=	3.87			(29)
Total area of elements, m²			132.22							(31)
Party wall			33.4	x	0	=	0			(32)

* *for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

** *include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	38.02	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	11.46	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	49.47	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	36.52	36.29	36.06	34.97	34.76	33.82	33.82	33.64	34.18	34.76	35.18	35.61	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	86	85.76	85.53	84.44	84.24	83.29	83.29	83.11	83.66	84.24	84.65	85.08	

Average = Sum(39)$_{1\ldots12}$ /12= 84.44 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.12	1.12	1.11	1.1	1.1	1.08	1.08	1.08	1.09	1.1	1.1	1.11	

Average = Sum(40)$_{1\ldots12}$ /12= 1.1 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.4 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.21 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.34	96.69	93.04	89.39	85.74	82.09	82.09	85.74	89.39	93.04	96.69	100.34	

Total = Sum(44)$_{1\ldots12}$ = 1094.57 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	148.79	130.14	134.29	117.08	112.34	96.94	89.83	103.08	104.31	121.56	132.7	144.1	

Total = Sum(45)$_{1\ldots12}$ = 1435.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.32	19.52	20.14	17.56	16.85	14.54	13.47	15.46	15.65	18.23	19.9	21.61	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	195.39	172.22	180.88	162.17	158.93	142.03	136.42	149.67	149.4	168.16	177.79	190.69	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	195.39	172.22	180.88	162.17	158.93	142.03	136.42	149.67	149.4	168.16	177.79	190.69	

Output from water heater (annual)$_{1...12}$	1983.77	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.75	76.94	81.93	75	74.63	68.31	67.14	71.55	70.76	77.7	80.19	85.19	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.28	17.13	13.93	10.54	7.88	6.65	7.19	9.35	12.54	15.93	18.59	19.82	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	212.75	214.96	209.4	197.55	182.6	168.55	159.16	156.96	162.52	174.36	189.31	203.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35	35	35	35	35	35	35	35	35	35	35	35	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	(71)

Water heating gains (Table 5)

(72)m=	116.6	114.49	110.12	104.17	100.31	94.87	90.25	96.17	98.27	104.43	111.38	114.5	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	410.64	408.59	395.45	374.28	352.8	332.08	318.61	324.48	335.35	356.73	381.3	399.69	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	6.9	x	46.75	x	0.63	x	0.7	=	98.59	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.63	x	0.7	=	26.29	(78)

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South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	6.9	x	76.57	x	0.63	x	0.7	=	161.46	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.63	x	0.7	=	43.06	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	6.9	x	97.53	x	0.63	x	0.7	=	205.67	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.63	x	0.7	=	54.85	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	6.9	x	110.23	x	0.63	x	0.7	=	232.45	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.63	x	0.7	=	61.99	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	6.9	x	114.87	x	0.63	x	0.7	=	242.23	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.63	x	0.7	=	64.6	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	6.9	x	110.55	x	0.63	x	0.7	=	233.12	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.63	x	0.7	=	62.16	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	6.9	x	108.01	x	0.63	x	0.7	=	227.77	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.63	x	0.7	=	60.74	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	6.9	x	104.89	x	0.63	x	0.7	=	221.19	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.63	x	0.7	=	58.99	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	6.9	x	101.89	x	0.63	x	0.7	=	214.85	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.63	x	0.7	=	57.29	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	6.9	x	82.59	x	0.63	x	0.7	=	174.15	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.63	x	0.7	=	46.44	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	6.9	x	55.42	x	0.63	x	0.7	=	116.86	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.63	x	0.7	=	31.16	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	6.9	x	40.4	x	0.63	x	0.7	=	85.19	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.63	x	0.7	=	22.72	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)

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West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	180.88	301.51	396.16	465.26	499.11	486.18	472.58	448.52	420.15	328.71	215.42	155.6	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	591.52	710.1	791.61	839.54	851.91	818.26	791.19	773	755.5	685.44	596.72	555.3	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.91	0.8	0.63	0.46	0.49	0.71	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.96	20.16	20.41	20.68	20.88	20.97	21	20.99	20.95	20.7	20.27	19.92	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.99	19.99	19.99	20	20	20.01	20.01	20.02	20.01	20	20	20	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.88	0.75	0.54	0.36	0.39	0.63	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.61	18.91	19.27	19.65	19.89	20	20.01	20.01	19.97	19.68	19.08	18.57	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.15	19.41	19.72	20.06	20.28	20.39	20.41	20.41	20.36	20.09	19.56	19.11	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.15	19.41	19.72	20.06	20.28	20.39	20.41	20.41	20.36	20.09	19.56	19.11	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.88	0.76	0.57	0.4	0.43	0.66	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	585.38	692.57	749.23	741.62	650.52	469.48	315.46	330.72	497.91	614.36	582.94	550.95	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1277.16	1244.42	1131.08	942.34	723.14	482.12	316.99	332.95	524.06	799.19	1054.74	1268.39	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	514.68	370.84	284.09	144.52	54.03	0	0	0	0	137.51	339.69	533.77	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2379.14 (98)

Space heating requirement in kWh/m²/year 30.95 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	514.68	370.84	284.09	144.52	54.03	0	0	0	0	137.51	339.69	533.77		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	550.46	396.62	303.84	154.56	57.78	0	0	0	0	147.07	363.31	570.88		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2544.53	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	195.39	172.22	180.88	162.17	158.93	142.03	136.42	149.67	149.4	168.16	177.79	190.69		
Efficiency of water heater													79.8	(216)
(217)m=	87.28	86.81	86.01	84.51	82.27	79.8	79.8	79.8	79.8	84.28	86.51	87.41		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	223.87	198.39	210.3	191.9	193.19	177.98	170.96	187.56	187.22	199.52	205.5	218.15		
Total = Sum(219a)$_{1...12}$ =													2364.53	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2544.53	
Water heating fuel used			2364.53	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			340.54	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	549.62	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	510.74	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1060.36	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	176.74	(268)
Total CO2, kg/year		sum of (265)…(271) =		1276.02	(272)

TER =	16.6	(273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-2-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.72	(1a) x	2.4	(2a) =	176.93	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.72	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.93	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Floor			73.72	x	0.11	=	8.1092			(28)
Walls Type1	41.25	15.64	25.61	x	0.18	=	4.61			(29)
Walls Type2	32.91	2.1	30.81	x	0.18	=	5.55			(29)
Total area of elements, m²			147.88							(31)
Party wall			15.07	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	38.69	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		13.83	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	52.52	(37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19		(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	81.71	81.71	81.71	81.71	81.71	81.71	81.71	81.71	81.71	81.71	81.71	81.71		
									Average = $Sum(39)_{1...12}$ /12=				81.71	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11		
									Average = $Sum(40)_{1...12}$ /12=				1.11	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.61 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)														
(44)m=	98.57	94.98	91.4	87.82	84.23	80.65	80.65	84.23	87.82	91.4	94.98	98.57		
									Total = $Sum(44)_{1...12}$ =				1075.29	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)														
(45)m=	146.17	127.84	131.92	115.01	110.36	95.23	88.25	101.26	102.47	119.42	130.36	141.56		
									Total = $Sum(45)_{1...12}$ =				1409.88	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)														
(46)m=	21.93	19.18	19.79	17.25	16.55	14.28	13.24	15.19	15.37	17.91	19.55	21.23		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.45	177.77	187.2	168.51	165.64	148.73	143.52	156.54	155.97	174.7	183.85	196.84	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.45	177.77	187.2	168.51	165.64	148.73	143.52	156.54	155.97	174.7	183.85	196.84

Output from water heater (annual)$_{1…12}$ — 2060.72 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.82	82.45	88.09	81.04	80.92	74.46	73.56	77.89	76.87	83.93	86.14	91.29	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.35	16.3	13.25	10.03	7.5	6.33	6.84	8.89	11.94	15.16	17.69	18.86	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.82	207.95	202.57	191.12	176.65	163.06	153.98	151.84	157.22	168.68	183.14	196.74	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	(71)

Water heating gains (Table 5)

(72)m=	124.76	122.69	118.4	112.55	108.76	103.42	98.88	104.69	106.76	112.81	119.64	122.7	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	406.93	404.94	392.22	371.7	350.9	330.8	317.69	323.42	333.91	354.64	378.47	396.29	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)

West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	161.2	273.58	370.43	450.44	495.29	487.26	471.65	439.12	398.42	301.43	192.93	138.04	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	568.13	678.52	762.64	822.13	846.2	818.06	789.34	762.55	732.33	656.07	571.4	534.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.79	0.61	0.45	0.49	0.71	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.17	20.42	20.69	20.88	20.97	21	20.99	20.95	20.69	20.26	19.92	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.88	0.73	0.53	0.35	0.38	0.63	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.64	18.92	19.28	19.64	19.89	19.98	19.99	19.99	19.96	19.66	19.07	18.57	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.17	19.42	19.74	20.06	20.28	20.38	20.39	20.39	20.35	20.07	19.55	19.11	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.17	19.42	19.74	20.06	20.28	20.38	20.39	20.39	20.35	20.07	19.55	19.11	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.88	0.75	0.56	0.39	0.42	0.66	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	562.17	661.91	720.98	722.04	635.26	460.04	308.51	323.92	484.02	589.61	558.37	530.1	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1215.45	1186.63	1081.64	911.97	701.49	472.03	310	326.23	510.87	773.75	1016.98	1218.17	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	486.04	352.61	268.33	136.75	49.28	0	0	0	0	137	330.2	511.93	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2272.12	(98)
Space heating requirement in kWh/m²/year	30.82	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.			
Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)
The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.			
Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2272.12	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2385.73	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2060.72	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2163.75	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	45.49	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.7	(330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	47.7	(331)
Energy for lighting (calculated in Appendix L)		324.05	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1056.65	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	23.61	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1080.27	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1080.27	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	24.76	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	168.18	(379)
Total CO2, kg/year	sum of (376)…(382) =				1273.2	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17.27	(384)
EI rating (section 14)					85.63	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-2-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.72	(1a) x	2.4	(2a) =	176.93	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.72	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.93	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.45	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 5			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Floor			73.72	x	0.13	=	9.5836			(28)
Walls Type1	41.25	15.64	25.61	x	0.18	=	4.61			(29)
Walls Type2	32.91	2.1	30.81	x	0.18	=	5.55			(29)
Total area of elements, m²			147.88							(31)
Party wall			15.07	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.57 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 13.09 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 55.66 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.23	34.99	34.76	33.69	33.48	32.54	32.54	32.37	32.91	33.48	33.89	34.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	90.89	90.66	90.43	89.35	89.15	88.21	88.21	88.03	88.57	89.15	89.56	89.98	

Average = Sum(39)$_{1\ldots12}$ /12= 89.35 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.23	1.23	1.23	1.21	1.21	1.2	1.2	1.19	1.2	1.21	1.21	1.22	

Average = Sum(40)$_{1\ldots12}$ /12= 1.21 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.61 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	98.57	94.98	91.4	87.82	84.23	80.65	80.65	84.23	87.82	91.4	94.98	98.57	

Total = Sum(44)$_{1\ldots12}$ = 1075.29 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.17	127.84	131.92	115.01	110.36	95.23	88.25	101.26	102.47	119.42	130.36	141.56	

Total = Sum(45)$_{1\ldots12}$ = 1409.88 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.93	19.18	19.79	17.25	16.55	14.28	13.24	15.19	15.37	17.91	19.55	21.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	192.77	169.93	178.52	160.11	156.95	140.32	134.84	147.86	147.57	166.02	175.45	188.16	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	192.77	169.93	178.52	160.11	156.95	140.32	134.84	147.86	147.57	166.02	175.45	188.16

Output from water heater (annual)$_{1…12}$ | 1958.49 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.88	76.18	81.14	74.32	73.97	67.74	66.62	70.95	70.15	76.98	79.42	84.35	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.39	16.33	13.28	10.05	7.52	6.35	6.86	8.91	11.96	15.19	17.73	18.9	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.82	207.95	202.57	191.12	176.65	163.06	153.98	151.84	157.22	168.68	183.14	196.74	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	(71)

Water heating gains (Table 5)

(72)m=	115.43	113.36	109.06	103.22	99.42	94.08	89.54	95.36	97.42	103.47	110.3	113.37	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	400.63	398.64	385.91	365.38	344.58	324.48	311.37	317.11	327.6	348.34	372.17	390	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.63	x	0.7	=	65.72	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.63	x	0.7	=	107.64	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.63	x	0.7	=	137.12	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.63	x	0.7	=	154.97	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.63	x	0.7	=	161.49	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.63	x	0.7	=	155.41	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.63	x	0.7	=	151.85	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.63	x	0.7	=	147.46	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.63	x	0.7	=	143.23	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.63	x	0.7	=	116.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.63	x	0.7	=	77.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.63	x	0.7	=	56.79	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)

West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	177.73	301.62	408.39	496.61	546.06	537.21	520	484.13	439.26	332.33	212.71	152.19	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	578.36	700.26	794.3	861.99	890.64	861.68	831.36	801.24	766.86	680.67	584.88	542.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.91	0.8	0.62	0.46	0.5	0.72	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.82	20.03	20.31	20.62	20.85	20.97	20.99	20.99	20.93	20.63	20.16	19.78	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.89	19.9	19.9	19.91	19.91	19.92	19.92	19.92	19.92	19.91	19.91	19.9	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.88	0.74	0.53	0.35	0.38	0.64	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.34	18.66	19.06	19.49	19.78	19.9	19.92	19.92	19.87	19.51	18.85	18.29	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.93	19.21	19.56	19.94	20.21	20.33	20.35	20.35	20.29	19.96	19.37	18.89	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.93	19.21	19.56	19.94	20.21	20.33	20.35	20.35	20.29	19.96	19.37	18.89	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.97	0.95	0.88	0.76	0.57	0.4	0.43	0.67	0.9	0.98	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	572.07	682.67	750.74	757.7	673.09	488.96	328.51	344.27	512.76	613.09	571.38	537.69		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	1329.94	1297.04	1180.94	986.79	758.23	505.19	330.76	347.65	548.49	834.17	1099.18	1321.55		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	563.86	412.86	320.07	164.95	63.35	0	0	0	0	164.48	380.01	583.19		
Total per year (kWh/year) = Sum(98)1...5,9...12 =													2652.76	(98)
Space heating requirement in kWh/m²/year													35.98	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	563.86	412.86	320.07	164.95	63.35	0	0	0	0	164.48	380.01	583.19		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	603.06	441.56	342.32	176.42	67.75	0	0	0	0	175.92	406.43	623.73		
Total (kWh/year) =Sum(211)1...5,10...12=													2837.18	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)1...5,10...12=													0	(215)

Water heating

Output from water heater (calculated above)														
	192.77	169.93	178.52	160.11	156.95	140.32	134.84	147.86	147.57	166.02	175.45	188.16		
Efficiency of water heater													79.8	(216)
(217)m=	87.51	87.09	86.35	84.89	82.61	79.8	79.8	79.8	79.8	84.79	86.82	87.63		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	220.28	195.11	206.73	188.6	190	175.84	168.97	185.29	184.92	195.8	202.08	214.71		
Total = Sum(219a)1...12 =													2328.33	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2837.18

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Water heating fuel used			2328.33	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			324.72	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	612.83	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	502.92	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1115.75	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	168.53	(268)
Total CO2, kg/year			sum of (265)…(271) =		1323.2	(272)
TER =					17.95	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-2-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.77	(1a) x	2.4	(2a) =	169.85	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.77	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	169.85	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 4			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Floor			70.77	x	0.11	=	7.784699			(28)
Walls Type1	35.57	16.33	19.24	x	0.18	=	3.46			(29)
Walls Type2	47.73	2.1	45.63	x	0.18	=	8.21			(29)
Total area of elements, m²			154.07							(31)
Party wall			15.1	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.68 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.88 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 56.56 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.02	28.02	28.02	28.02	28.02	28.02	28.02	28.02	28.02	28.02	28.02	28.02	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	84.59	84.59	84.59	84.59	84.59	84.59	84.59	84.59	84.59	84.59	84.59	84.59	

Average = Sum(39)$_{1\ldots12}$ /12= 84.59 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	

Average = Sum(40)$_{1\ldots12}$ /12= 1.2 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.26 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.99 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.78	93.27	89.75	86.23	82.71	79.19	79.19	82.71	86.23	89.75	93.27	96.78	

Total = Sum(44)$_{1\ldots12}$ = 1055.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.53	125.53	129.54	112.93	108.36	93.51	86.65	99.43	100.62	117.26	128	139	

Total = Sum(45)$_{1\ldots12}$ = 1384.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.53	18.83	19.43	16.94	16.25	14.03	13	14.91	15.09	17.59	19.2	20.85	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	198.81	175.46	184.81	166.43	163.64	147	141.93	154.71	154.11	172.54	181.49	194.28	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	198.81	175.46	184.81	166.43	163.64	147	141.93	154.71	154.11	172.54	181.49	194.28

Output from water heater (annual)$_{1…12}$ | 2035.2 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.94	81.68	87.29	80.35	80.25	73.89	73.03	77.28	76.25	83.21	85.36	90.44	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.75	15.76	12.82	9.71	7.26	6.13	6.62	8.6	11.55	14.66	17.11	18.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.09	201.15	195.95	184.86	170.87	157.73	148.94	146.88	152.08	163.16	177.15	190.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	(71)

Water heating gains (Table 5)

(72)m=	123.58	121.55	117.33	111.59	107.87	102.62	98.16	103.87	105.9	111.84	118.55	121.56	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	397.39	395.44	383.07	363.13	342.96	323.44	310.69	316.32	326.5	346.64	369.79	387.07	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	4.6	x	10.63	x	0.5	x	0.8	=	13.56	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.5	x	0.8	=	25.91	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	4.6	x	34.53	x	0.5	x	0.8	=	44.03	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.5	x	0.8	=	70.72	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.5	x	0.8	=	95.27	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.5	x	0.8	=	101.99	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.5	x	0.8	=	95.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.5	x	0.8	=	75.55	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.5	x	0.8	=	52.94	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.5	x	0.8	=	30.84	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.5	x	0.8	=	16.73	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.5	x	0.8	=	11.3	(74)
West	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(80)

West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.23	132.37	220.45	333.22	423.85	441.92	417.35	347.25	259.5	157.25	84.75	56.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	465.62	527.81	603.51	696.35	766.82	765.36	728.04	663.57	586	503.89	454.54	443.46	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.84	0.66	0.5	0.57	0.83	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.75	19.9	20.17	20.52	20.81	20.96	20.99	20.98	20.87	20.49	20.05	19.71	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.79	0.57	0.38	0.44	0.75	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.27	18.48	18.87	19.37	19.75	19.9	19.92	19.92	19.82	19.33	18.7	18.21	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.86	19.05	19.39	19.83	20.17	20.32	20.35	20.34	20.24	19.79	19.24	18.81	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.86	19.05	19.39	19.83	20.17	20.32	20.35	20.34	20.24	19.79	19.24	18.81	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.92	0.8	0.61	0.43	0.49	0.78	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	463.08	522.31	587.94	643.08	613.85	463.39	313.95	327.68	454.86	480.67	449.73	441.53	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1231.82	1196.83	1090.36	924.45	716.68	483.8	317.09	333.6	519.49	777.66	1026.87	1235.98	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	571.94	453.28	373.8	202.59	76.5	0	0	0	0	220.96	415.54	591.07	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2905.67 (98)

Space heating requirement in kWh/m²/year 41.06 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2905.67	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	3050.96	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2035.2	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2136.96	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	51.88	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		45.79	(330a)

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warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =		45.79	(331)
Energy for lighting (calculated in Appendix L)			313.45	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1204.94	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	26.93	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1231.86	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1231.86	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	23.77	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	162.68	(379)
Total CO2, kg/year	sum of (376)…(382) =				1418.31	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				20.04	(384)
EI rating (section 14)					83.58	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-2-07

Address :	Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.77	(1a) x	2.4	(2a) =	169.85	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.77	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		169.85	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.43	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.34	0.36	0.39	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: | 0 | (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) | 0 | (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 0 | (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.76	x1/[1/(1.4)+ 0.04]		=	2.33			(27)
Windows Type 2			1.76	x1/[1/(1.4)+ 0.04]		=	2.33			(27)
Windows Type 3			4.39	x1/[1/(1.4)+ 0.04]		=	5.82			(27)
Windows Type 4			5.05	x1/[1/(1.4)+ 0.04]		=	6.7			(27)
Windows Type 5			2.64	x1/[1/(1.4)+ 0.04]		=	3.5			(27)
Floor			70.77	x	0.13	=	9.200099			(28)
Walls Type1	35.57	15.6	19.97	x	0.18	=	3.59			(29)
Walls Type2	47.73	2.1	45.63	x	0.18	=	8.21			(29)
Total area of elements, m²			154.07							(31)
Party wall			15.1	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	43.79	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		14.84	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	58.63	(37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.02	33.78	33.56	32.48	32.28	31.35	31.35	31.18	31.71	32.28	32.69	33.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	92.65	92.42	92.19	91.12	90.92	89.99	89.99	89.81	90.34	90.92	91.32	91.75	

Average = $\text{Sum}(39)_{1...12}$ /12= 91.12 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.31	1.31	1.3	1.29	1.28	1.27	1.27	1.27	1.28	1.28	1.29	1.3

Average = $\text{Sum}(40)_{1...12}$ /12= 1.29 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.26 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.99 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.78	93.27	89.75	86.23	82.71	79.19	79.19	82.71	86.23	89.75	93.27	96.78

Total = $\text{Sum}(44)_{1...12}$ = 1055.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.53	125.53	129.54	112.93	108.36	93.51	86.65	99.43	100.62	117.26	128	139

Total = $\text{Sum}(45)_{1...12}$ = 1384.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.53	18.83	19.43	16.94	16.25	14.03	13	14.91	15.09	17.59	19.2	20.85	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	190.12	167.62	176.13	158.03	154.96	138.6	133.24	146.03	145.71	163.86	173.09	185.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	190.12	167.62	176.13	158.03	154.96	138.6	133.24	146.03	145.71	163.86	173.09	185.59

Output from water heater (annual)1…12 — 1932.98 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85	75.41	80.35	73.62	73.31	67.17	66.09	70.34	69.53	76.27	78.63	83.49	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.75	15.77	12.82	9.71	7.26	6.13	6.62	8.61	11.55	14.67	17.12	18.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.09	201.15	195.95	184.86	170.87	157.73	148.94	146.88	152.08	163.16	177.15	190.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	(71)

Water heating gains (Table 5)

(72)m=	114.25	112.21	107.99	102.26	98.53	93.28	88.83	94.54	96.57	102.51	109.21	112.22	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	391.06	389.11	376.73	356.8	336.63	317.11	304.36	309.99	320.17	340.31	363.45	380.74	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	1.76	x	10.63	x	0.63	x	0.7	=	5.72	(74)
North	0.9x	0.77	x	1.76	x	10.63	x	0.63	x	0.7	=	5.72	(74)
North	0.9x	0.77	x	4.39	x	10.63	x	0.63	x	0.7	=	14.27	(74)
North	0.9x	0.77	x	1.76	x	20.32	x	0.63	x	0.7	=	10.93	(74)
North	0.9x	0.77	x	1.76	x	20.32	x	0.63	x	0.7	=	10.93	(74)
North	0.9x	0.77	x	4.39	x	20.32	x	0.63	x	0.7	=	27.26	(74)
North	0.9x	0.77	x	1.76	x	34.53	x	0.63	x	0.7	=	18.57	(74)
North	0.9x	0.77	x	1.76	x	34.53	x	0.63	x	0.7	=	18.57	(74)
North	0.9x	0.77	x	4.39	x	34.53	x	0.63	x	0.7	=	46.33	(74)
North	0.9x	0.77	x	1.76	x	55.46	x	0.63	x	0.7	=	29.83	(74)
North	0.9x	0.77	x	1.76	x	55.46	x	0.63	x	0.7	=	29.83	(74)
North	0.9x	0.77	x	4.39	x	55.46	x	0.63	x	0.7	=	74.41	(74)
North	0.9x	0.77	x	1.76	x	74.72	x	0.63	x	0.7	=	40.19	(74)
North	0.9x	0.77	x	1.76	x	74.72	x	0.63	x	0.7	=	40.19	(74)
North	0.9x	0.77	x	4.39	x	74.72	x	0.63	x	0.7	=	100.24	(74)
North	0.9x	0.77	x	1.76	x	79.99	x	0.63	x	0.7	=	43.02	(74)
North	0.9x	0.77	x	1.76	x	79.99	x	0.63	x	0.7	=	43.02	(74)
North	0.9x	0.77	x	4.39	x	79.99	x	0.63	x	0.7	=	107.31	(74)
North	0.9x	0.77	x	1.76	x	74.68	x	0.63	x	0.7	=	40.17	(74)
North	0.9x	0.77	x	1.76	x	74.68	x	0.63	x	0.7	=	40.17	(74)
North	0.9x	0.77	x	4.39	x	74.68	x	0.63	x	0.7	=	100.19	(74)
North	0.9x	0.77	x	1.76	x	59.25	x	0.63	x	0.7	=	31.87	(74)
North	0.9x	0.77	x	1.76	x	59.25	x	0.63	x	0.7	=	31.87	(74)
North	0.9x	0.77	x	4.39	x	59.25	x	0.63	x	0.7	=	79.49	(74)
North	0.9x	0.77	x	1.76	x	41.52	x	0.63	x	0.7	=	22.33	(74)
North	0.9x	0.77	x	1.76	x	41.52	x	0.63	x	0.7	=	22.33	(74)
North	0.9x	0.77	x	4.39	x	41.52	x	0.63	x	0.7	=	55.7	(74)
North	0.9x	0.77	x	1.76	x	24.19	x	0.63	x	0.7	=	13.01	(74)
North	0.9x	0.77	x	1.76	x	24.19	x	0.63	x	0.7	=	13.01	(74)
North	0.9x	0.77	x	4.39	x	24.19	x	0.63	x	0.7	=	32.45	(74)
North	0.9x	0.77	x	1.76	x	13.12	x	0.63	x	0.7	=	7.06	(74)
North	0.9x	0.77	x	1.76	x	13.12	x	0.63	x	0.7	=	7.06	(74)
North	0.9x	0.77	x	4.39	x	13.12	x	0.63	x	0.7	=	17.6	(74)
North	0.9x	0.77	x	1.76	x	8.86	x	0.63	x	0.7	=	4.77	(74)
North	0.9x	0.77	x	1.76	x	8.86	x	0.63	x	0.7	=	4.77	(74)
North	0.9x	0.77	x	4.39	x	8.86	x	0.63	x	0.7	=	11.89	(74)
West	0.9x	0.77	x	5.05	x	19.64	x	0.63	x	0.7	=	30.31	(80)
West	0.9x	0.77	x	2.64	x	19.64	x	0.63	x	0.7	=	15.85	(80)
West	0.9x	0.77	x	5.05	x	38.42	x	0.63	x	0.7	=	59.3	(80)
West	0.9x	0.77	x	2.64	x	38.42	x	0.63	x	0.7	=	31	(80)
West	0.9x	0.77	x	5.05	x	63.27	x	0.63	x	0.7	=	97.65	(80)

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West	0.9x	0.77	x	2.64	x	63.27	x	0.63	x	0.7	=	51.05	(80)
West	0.9x	0.77	x	5.05	x	92.28	x	0.63	x	0.7	=	142.42	(80)
West	0.9x	0.77	x	2.64	x	92.28	x	0.63	x	0.7	=	74.45	(80)
West	0.9x	0.77	x	5.05	x	113.09	x	0.63	x	0.7	=	174.54	(80)
West	0.9x	0.77	x	2.64	x	113.09	x	0.63	x	0.7	=	91.25	(80)
West	0.9x	0.77	x	5.05	x	115.77	x	0.63	x	0.7	=	178.67	(80)
West	0.9x	0.77	x	2.64	x	115.77	x	0.63	x	0.7	=	93.41	(80)
West	0.9x	0.77	x	5.05	x	110.22	x	0.63	x	0.7	=	170.1	(80)
West	0.9x	0.77	x	2.64	x	110.22	x	0.63	x	0.7	=	88.93	(80)
West	0.9x	0.77	x	5.05	x	94.68	x	0.63	x	0.7	=	146.12	(80)
West	0.9x	0.77	x	2.64	x	94.68	x	0.63	x	0.7	=	76.39	(80)
West	0.9x	0.77	x	5.05	x	73.59	x	0.63	x	0.7	=	113.57	(80)
West	0.9x	0.77	x	2.64	x	73.59	x	0.63	x	0.7	=	59.37	(80)
West	0.9x	0.77	x	5.05	x	45.59	x	0.63	x	0.7	=	70.36	(80)
West	0.9x	0.77	x	2.64	x	45.59	x	0.63	x	0.7	=	36.78	(80)
West	0.9x	0.77	x	5.05	x	24.49	x	0.63	x	0.7	=	37.8	(80)
West	0.9x	0.77	x	2.64	x	24.49	x	0.63	x	0.7	=	19.76	(80)
West	0.9x	0.77	x	5.05	x	16.15	x	0.63	x	0.7	=	24.93	(80)
West	0.9x	0.77	x	2.64	x	16.15	x	0.63	x	0.7	=	13.03	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	71.86	139.42	232.18	350.95	446.4	465.44	439.55	365.73	273.31	165.62	89.26	59.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	462.92	528.52	608.91	707.75	783.04	782.54	743.91	675.72	593.48	505.92	452.72	440.13	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.85	0.68	0.52	0.59	0.84	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.6	19.76	20.05	20.44	20.77	20.94	20.99	20.98	20.84	20.41	19.94	19.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.83	19.84	19.84	19.85	19.85	19.86	19.86	19.87	19.86	19.85	19.85	19.84	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.8	0.58	0.39	0.45	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.99	18.22	18.64	19.21	19.63	19.83	19.86	19.86	19.73	19.18	18.49	17.96	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.63	18.83	19.2	19.7	20.09	20.27	20.31	20.3	20.18	19.67	19.07	18.6	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.63	18.83	19.2	19.7	20.09	20.27	20.31	20.3	20.18	19.67	19.07	18.6	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.93	0.81	0.62	0.44	0.51	0.79	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	460.38	523.04	593.64	655.87	634.63	483.62	329.32	342.5	468.08	483.88	448.04	438.2	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1327.83	1287.77	1171.15	984.15	762.52	510.47	333.84	350.7	548.87	824.79	1093.31	1321.56	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	645.38	513.89	429.67	236.36	95.15	0	0	0	0	253.63	464.59	657.22	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3295.9 (98)

Space heating requirement in kWh/m²/year 46.57 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	645.38	513.89	429.67	236.36	95.15	0	0	0	0	253.63	464.59	657.22		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	690.25	549.62	459.54	252.79	101.77	0	0	0	0	271.26	496.89	702.91		
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													3525.03	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)
Water heating														
Output from water heater (calculated above)														
	190.12	167.62	176.13	158.03	154.96	138.6	133.24	146.03	145.71	163.86	173.09	185.59		
Efficiency of water heater													79.8	(216)
(217)m=	87.82	87.61	87.1	85.89	83.56	79.8	79.8	79.8	79.8	85.98	87.32	87.9		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	216.49	191.32	202.21	183.99	185.45	173.68	166.97	182.99	182.59	190.59	198.22	211.13		
Total = Sum(219a)$_{1...12}$ =													2285.64	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3525.03

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Water heating fuel used			2285.64	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			313.54	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	761.41	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	493.7	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1255.11	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	162.73	(268)
Total CO2, kg/year		sum of (265)…(271) =		1456.76	(272)

TER = 20.58 (273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-2-08

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	73.39	(1a)	x	2.4	(2a)	=	176.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.39	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			176.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			6.9	x1/[1/(1.2)+ 0.04]		=	7.9			(27)
Floor			73.39	x	0.11	=	8.0729			(28)
Walls Type1	40.92	17.94	22.98	x	0.18	=	4.14			(29)
Walls Type2	21.61	2.1	19.51	x	0.18	=	3.51			(29)
Total area of elements, m²			135.92							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	38.78	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.54 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 54.33 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	83.39	83.39	83.39	83.39	83.39	83.39	83.39	83.39	83.39	83.39	83.39	83.39	

Average = Sum(39)$_{1…12}$ /12= 83.39 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	

Average = Sum(40)$_{1…12}$ /12= 1.14 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.37	94.8	91.22	87.64	84.07	80.49	80.49	84.07	87.64	91.22	94.8	98.37	

Total = Sum(44)$_{1…12}$ = 1073.18 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.89	127.59	131.67	114.79	110.14	95.04	88.07	101.06	102.27	119.19	130.1	141.28	

Total = Sum(45)$_{1…12}$ = 1407.11 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.88	19.14	19.75	17.22	16.52	14.26	13.21	15.16	15.34	17.88	19.52	21.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.16	177.52	186.94	168.28	165.42	148.54	143.35	156.34	155.77	174.46	183.6	196.56	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.16	177.52	186.94	168.28	165.42	148.54	143.35	156.34	155.77	174.46	183.6	196.56

Output from water heater (annual)$_{1...12}$ — 2057.94 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.73	82.37	88	80.96	80.84	74.4	73.51	77.83	76.8	83.85	86.05	91.2	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.28	16.24	13.21	10	7.47	6.31	6.82	8.86	11.89	15.1	17.63	18.79	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.08	207.2	201.84	190.43	176.01	162.47	153.42	151.29	156.66	168.07	182.48	196.03	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	(71)

Water heating gains (Table 5)

(72)m=	124.64	122.57	118.28	112.45	108.66	103.33	98.8	104.6	106.67	112.7	119.52	122.58	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	405.88	403.9	391.21	370.75	350.03	329.99	316.92	322.64	333.1	353.76	377.51	395.28	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	6.9	x	19.64	x	0.5	x	0.8	=	37.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	6.9	x	38.42	x	0.5	x	0.8	=	73.49	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	6.9	x	63.27	x	0.5	x	0.8	=	121.02	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	6.9	x	92.28	x	0.5	x	0.8	=	176.5	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	6.9	x	113.09	x	0.5	x	0.8	=	216.31	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)

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West	0.9x	0.77	x	6.9	x	115.77	x	0.5	x	0.8	=	221.43	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	6.9	x	110.22	x	0.5	x	0.8	=	210.81	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	6.9	x	94.68	x	0.5	x	0.8	=	181.08	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	6.9	x	73.59	x	0.5	x	0.8	=	140.75	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	6.9	x	45.59	x	0.5	x	0.8	=	87.2	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	6.9	x	24.49	x	0.5	x	0.8	=	46.84	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	6.9	x	16.15	x	0.5	x	0.8	=	30.89	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	83.89	163.37	270.67	402.57	503.68	520.97	493.73	416.61	316.88	193.97	104.38	69.17	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	489.77	567.26	661.89	773.33	853.72	850.96	810.65	739.25	649.98	547.73	481.9	464.45	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.79	0.6	0.45	0.51	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.84	20	20.28	20.62	20.87	20.97	21	20.99	20.91	20.56	20.13	19.8	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.74	0.52	0.35	0.4	0.7	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.43	18.67	19.07	19.54	19.86	19.96	19.97	19.97	19.91	19.47	18.85	18.37	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19	19.2	19.55	19.98	20.26	20.36	20.38	20.38	20.31	19.91	19.36	18.94	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19	19.2	19.55	19.98	20.26	20.36	20.38	20.38	20.31	19.91	19.36	18.94	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.9	0.75	0.55	0.39	0.44	0.73	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	486.96	560.33	640.04	695.9	642.78	468.71	313.62	328.52	473.39	516.51	476.24	462.37	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1225.44	1192.42	1088.45	923.59	714.03	480.6	315.22	331.68	517.73	776.38	1022.5	1229.24	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	549.43	424.76	333.62	163.94	53.01	0	0	0	0	193.35	393.31	570.55	

	Total per year (kWh/year) = Sum(98)1...5,9...12 =	2681.97	(98)
Space heating requirement in kWh/m²/year		36.54	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2681.97	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2816.07	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2057.94	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2160.84	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	49.77	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.49	(330a)

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warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			47.49	(331)
Energy for lighting (calculated in Appendix L)				322.88	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1155.93	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	25.83	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1181.76	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1181.76	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	24.65	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	167.57	(379)
Total CO2, kg/year	sum of (376)…(382) =				1373.98	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				18.72	(384)
EI rating (section 14)					84.45	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-2-08

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.39	(1a) x	2.4	(2a) =	176.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 2			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 3			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 4			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 5			6.25	x1/[1/(1.4)+ 0.04]		=	8.29			(27)
Floor			73.39	x	0.13	=	9.5407			(28)
Walls Type1	40.92	16.25	24.67	x	0.18	=	4.44			(29)
Walls Type2	21.61	2.1	19.51	x	0.18	=	3.51			(29)
Total area of elements, m²			135.92							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	41.14	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		13.59	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	54.73	(37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.09	34.86	34.63	33.55	33.35	32.41	32.41	32.24	32.77	33.35	33.76	34.18	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	89.82	89.59	89.36	88.28	88.08	87.14	87.14	86.97	87.5	88.08	88.49	88.91	

Average = Sum(39)$_{1...12}$ /12= 88.28 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.22	1.22	1.22	1.2	1.2	1.19	1.19	1.19	1.19	1.2	1.21	1.21	

Average = Sum(40)$_{1...12}$ /12= 1.2 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	98.37	94.8	91.22	87.64	84.07	80.49	80.49	84.07	87.64	91.22	94.8	98.37	

Total = Sum(44)$_{1...12}$ = 1073.18 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.89	127.59	131.67	114.79	110.14	95.04	88.07	101.06	102.27	119.19	130.1	141.28	

Total = Sum(45)$_{1...12}$ = 1407.11 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.88	19.14	19.75	17.22	16.52	14.26	13.21	15.16	15.34	17.88	19.52	21.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	192.48	169.68	178.26	159.88	156.74	140.14	134.67	147.66	147.36	165.78	175.19	187.88	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	192.48	169.68	178.26	159.88	156.74	140.14	134.67	147.66	147.36	165.78	175.19	187.88

Output from water heater (annual)$_{1...12}$ | 1955.72 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.78	76.09	81.05	74.24	73.9	67.68	66.56	70.88	70.08	76.91	79.33	84.25	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.29	16.24	13.21	10	7.47	6.31	6.82	8.86	11.9	15.1	17.63	18.79	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.08	207.2	201.84	190.43	176.01	162.47	153.42	151.29	156.66	168.07	182.48	196.03	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	(71)

Water heating gains (Table 5)

(72)m=	115.3	113.23	108.94	103.11	99.33	93.99	89.46	95.27	97.33	103.37	110.18	113.24	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	399.55	397.56	384.88	364.42	343.7	323.66	310.59	316.31	326.77	347.43	371.18	388.95	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	2.5	x	10.63	x	0.63	x	0.7	=	8.12	(74)
North	0.9x	0.77	x	2.5	x	10.63	x	0.63	x	0.7	=	8.12	(74)
North	0.9x	0.77	x	2.5	x	20.32	x	0.63	x	0.7	=	15.53	(74)
North	0.9x	0.77	x	2.5	x	20.32	x	0.63	x	0.7	=	15.53	(74)
North	0.9x	0.77	x	2.5	x	34.53	x	0.63	x	0.7	=	26.38	(74)
North	0.9x	0.77	x	2.5	x	34.53	x	0.63	x	0.7	=	26.38	(74)
North	0.9x	0.77	x	2.5	x	55.46	x	0.63	x	0.7	=	42.38	(74)
North	0.9x	0.77	x	2.5	x	55.46	x	0.63	x	0.7	=	42.38	(74)
North	0.9x	0.77	x	2.5	x	74.72	x	0.63	x	0.7	=	57.09	(74)
North	0.9x	0.77	x	2.5	x	74.72	x	0.63	x	0.7	=	57.09	(74)
North	0.9x	0.77	x	2.5	x	79.99	x	0.63	x	0.7	=	61.11	(74)
North	0.9x	0.77	x	2.5	x	79.99	x	0.63	x	0.7	=	61.11	(74)
North	0.9x	0.77	x	2.5	x	74.68	x	0.63	x	0.7	=	57.06	(74)
North	0.9x	0.77	x	2.5	x	74.68	x	0.63	x	0.7	=	57.06	(74)
North	0.9x	0.77	x	2.5	x	59.25	x	0.63	x	0.7	=	45.27	(74)
North	0.9x	0.77	x	2.5	x	59.25	x	0.63	x	0.7	=	45.27	(74)
North	0.9x	0.77	x	2.5	x	41.52	x	0.63	x	0.7	=	31.72	(74)
North	0.9x	0.77	x	2.5	x	41.52	x	0.63	x	0.7	=	31.72	(74)
North	0.9x	0.77	x	2.5	x	24.19	x	0.63	x	0.7	=	18.48	(74)
North	0.9x	0.77	x	2.5	x	24.19	x	0.63	x	0.7	=	18.48	(74)
North	0.9x	0.77	x	2.5	x	13.12	x	0.63	x	0.7	=	10.02	(74)
North	0.9x	0.77	x	2.5	x	13.12	x	0.63	x	0.7	=	10.02	(74)
North	0.9x	0.77	x	2.5	x	8.86	x	0.63	x	0.7	=	6.77	(74)
North	0.9x	0.77	x	2.5	x	8.86	x	0.63	x	0.7	=	6.77	(74)
West	0.9x	0.77	x	2.5	x	19.64	x	0.63	x	0.7	=	15.01	(80)
West	0.9x	0.77	x	2.5	x	19.64	x	0.63	x	0.7	=	15.01	(80)
West	0.9x	0.77	x	6.25	x	19.64	x	0.63	x	0.7	=	37.51	(80)
West	0.9x	0.77	x	2.5	x	38.42	x	0.63	x	0.7	=	29.35	(80)
West	0.9x	0.77	x	2.5	x	38.42	x	0.63	x	0.7	=	29.35	(80)
West	0.9x	0.77	x	6.25	x	38.42	x	0.63	x	0.7	=	73.39	(80)
West	0.9x	0.77	x	2.5	x	63.27	x	0.63	x	0.7	=	48.34	(80)
West	0.9x	0.77	x	2.5	x	63.27	x	0.63	x	0.7	=	48.34	(80)
West	0.9x	0.77	x	6.25	x	63.27	x	0.63	x	0.7	=	120.86	(80)
West	0.9x	0.77	x	2.5	x	92.28	x	0.63	x	0.7	=	70.5	(80)
West	0.9x	0.77	x	2.5	x	92.28	x	0.63	x	0.7	=	70.5	(80)
West	0.9x	0.77	x	6.25	x	92.28	x	0.63	x	0.7	=	176.26	(80)
West	0.9x	0.77	x	2.5	x	113.09	x	0.63	x	0.7	=	86.41	(80)
West	0.9x	0.77	x	2.5	x	113.09	x	0.63	x	0.7	=	86.41	(80)
West	0.9x	0.77	x	6.25	x	113.09	x	0.63	x	0.7	=	216.02	(80)
West	0.9x	0.77	x	2.5	x	115.77	x	0.63	x	0.7	=	88.45	(80)
West	0.9x	0.77	x	2.5	x	115.77	x	0.63	x	0.7	=	88.45	(80)

West	0.9x	0.77	x	6.25	x	115.77	x	0.63	x	0.7	=	221.13	(80)
West	0.9x	0.77	x	2.5	x	110.22	x	0.63	x	0.7	=	84.21	(80)
West	0.9x	0.77	x	2.5	x	110.22	x	0.63	x	0.7	=	84.21	(80)
West	0.9x	0.77	x	6.25	x	110.22	x	0.63	x	0.7	=	210.53	(80)
West	0.9x	0.77	x	2.5	x	94.68	x	0.63	x	0.7	=	72.34	(80)
West	0.9x	0.77	x	2.5	x	94.68	x	0.63	x	0.7	=	72.34	(80)
West	0.9x	0.77	x	6.25	x	94.68	x	0.63	x	0.7	=	180.84	(80)
West	0.9x	0.77	x	2.5	x	73.59	x	0.63	x	0.7	=	56.22	(80)
West	0.9x	0.77	x	2.5	x	73.59	x	0.63	x	0.7	=	56.22	(80)
West	0.9x	0.77	x	6.25	x	73.59	x	0.63	x	0.7	=	140.56	(80)
West	0.9x	0.77	x	2.5	x	45.59	x	0.63	x	0.7	=	34.83	(80)
West	0.9x	0.77	x	2.5	x	45.59	x	0.63	x	0.7	=	34.83	(80)
West	0.9x	0.77	x	6.25	x	45.59	x	0.63	x	0.7	=	87.08	(80)
West	0.9x	0.77	x	2.5	x	24.49	x	0.63	x	0.7	=	18.71	(80)
West	0.9x	0.77	x	2.5	x	24.49	x	0.63	x	0.7	=	18.71	(80)
West	0.9x	0.77	x	6.25	x	24.49	x	0.63	x	0.7	=	46.78	(80)
West	0.9x	0.77	x	2.5	x	16.15	x	0.63	x	0.7	=	12.34	(80)
West	0.9x	0.77	x	2.5	x	16.15	x	0.63	x	0.7	=	12.34	(80)
West	0.9x	0.77	x	6.25	x	16.15	x	0.63	x	0.7	=	30.85	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	83.77	163.15	270.31	402.03	503	520.26	493.06	416.04	316.45	193.71	104.24	69.08	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	483.32	560.71	655.18	766.45	846.7	843.92	803.64	732.35	643.22	541.13	475.42	458.02	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.82	0.63	0.47	0.53	0.8	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.71	19.88	20.17	20.55	20.84	20.97	20.99	20.99	20.89	20.5	20.04	19.69	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.9	19.9	19.91	19.92	19.92	19.93	19.93	19.93	19.93	19.92	19.92	19.91	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.76	0.54	0.36	0.42	0.72	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.2	18.44	18.87	19.41	19.77	19.91	19.93	19.93	19.84	19.35	18.69	18.17	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.81	19.02	19.39	19.87	20.2	20.33	20.35	20.35	20.26	19.81	19.23	18.78	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.81	19.02	19.39	19.87	20.2	20.33	20.35	20.35	20.26	19.81	19.23	18.78	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.99	0.97	0.91	0.77	0.57	0.4	0.46	0.75	0.95	0.99	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	480.66	554.33	635.65	697.4	655.63	483.1	324.74	339.15	482.05	513.34	470.23	456.05		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	1302.94	1264.95	1152.01	968.15	748.29	499.44	327.13	343.66	539.06	811.32	1073.16	1296.02		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	611.78	477.54	384.17	194.94	68.94	0	0	0	0	221.7	434.11	624.94		
									Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =				3018.11	(98)
Space heating requirement in kWh/m²/year													41.12	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	611.78	477.54	384.17	194.94	68.94	0	0	0	0	221.7	434.11	624.94		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	654.31	510.73	410.88	208.49	73.73	0	0	0	0	237.11	464.29	668.38		
									Total (kWh/year) =Sum(211)$_{1...5,10....12}$=				3227.92	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
									Total (kWh/year) =Sum(215)$_{1...5,10....12}$=				0	(215)

Water heating

Output from water heater (calculated above)														
	192.48	169.68	178.26	159.88	156.74	140.14	134.67	147.66	147.36	165.78	175.19	187.88		
Efficiency of water heater													79.8	(216)
(217)m=	87.69	87.43	86.81	85.34	82.79	79.8	79.8	79.8	79.8	85.59	87.14	87.78		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	219.51	194.08	205.34	187.34	189.32	175.61	168.76	185.04	184.67	193.69	201.05	214.03		
									Total = Sum(219a)$_{1...12}$ =				2318.44	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3227.92

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Water heating fuel used			2318.44	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			322.93	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	697.23	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	500.78	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1198.01	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	167.6	(268)
Total CO2, kg/year			sum of (265)…(271) =		1404.54	(272)

TER = 19.14 (273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-3-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.98	(1a) x	2.4	(2a) =	172.75	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.98	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	172.75	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 2			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	41.71	17.94	23.77	x	0.18	=	4.28			(29)
Walls Type2	11.24	2.1	9.14	x	0.18	=	1.65			(29)
Total area of elements, m²			52.95							(31)
Party wall			43.65	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	28.99	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		10.3	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	39.29	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	67.79	67.79	67.79	67.79	67.79	67.79	67.79	67.79	67.79	67.79	67.79	67.79	

Average = Sum(39)$_{1...12}$ /12= 67.79 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.29 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.66 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.53	93.98	90.44	86.89	83.34	79.8	79.8	83.34	86.89	90.44	93.98	97.53	

Total = Sum(44)$_{1...12}$ = 1063.97 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.63	126.5	130.54	113.8	109.2	94.23	87.32	100.2	101.39	118.17	128.99	140.07	

Total = Sum(45)$_{1...12}$ = 1395.03 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.7	18.97	19.58	17.07	16.38	14.13	13.1	15.03	15.21	17.72	19.35	21.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.91	176.43	185.81	167.3	164.47	147.72	142.59	155.47	154.89	173.44	182.48	195.35	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.91	176.43	185.81	167.3	164.47	147.72	142.59	155.47	154.89	173.44	182.48	195.35

Output from water heater (annual)$_{1...12}$ | 2045.87 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.31	82	87.62	80.63	80.53	74.13	73.25	77.54	76.51	83.51	85.68	90.8	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18	15.98	13	9.84	7.36	6.21	6.71	8.72	11.71	14.87	17.35	18.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	201.87	203.97	198.69	187.45	173.27	159.93	151.03	148.93	154.21	165.45	179.63	192.97	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	(71)

Water heating gains (Table 5)

(72)m=	124.08	122.03	117.77	111.99	108.24	102.95	98.46	104.22	106.26	112.25	119	122.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	401.34	399.38	386.86	366.68	346.26	326.49	313.59	319.27	329.58	349.96	373.39	390.9	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)

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North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)

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North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
East	0.9x	1	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(76)
East	0.9x	1	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(76)
East	0.9x	1	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(76)
East	0.9x	1	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(76)
East	0.9x	1	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(76)
East	0.9x	1	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(76)
East	0.9x	1	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(76)
East	0.9x	1	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(76)
East	0.9x	1	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(76)
East	0.9x	1	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(76)
East	0.9x	1	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(76)
East	0.9x	1	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	66.09	127.6	213.87	329.81	427.83	450.24	423.48	346.58	253.49	151.67	81.91	54.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	467.43	526.98	600.73	696.49	774.09	776.73	737.08	665.85	583.07	501.63	455.3	445.67	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.76	0.55	0.4	0.47	0.75	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.1	20.23	20.46	20.75	20.94	20.99	21	21	20.96	20.7	20.34	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.89	0.7	0.48	0.32	0.38	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.92	19.12	19.46	19.85	20.08	20.13	20.13	20.13	20.1	19.78	19.27	18.87	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.39	19.56	19.86	20.21	20.42	20.47	20.48	20.48	20.44	20.15	19.7	19.34	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.39	19.56	19.86	20.21	20.42	20.47	20.48	20.48	20.44	20.15	19.7	19.34	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.97	0.89	0.72	0.51	0.36	0.41	0.7	0.94	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	464.96	521.1	581.78	622.08	557.62	394.36	262.55	275.53	408.75	471.48	450.08	443.85	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1023.2	993.99	905.6	766.85	591.18	398.12	262.93	276.43	429.95	647.33	854.02	1026.69	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	415.34	317.78	240.92	104.23	24.96	0	0	0	0	130.83	290.83	433.63

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1958.52	(98)
Space heating requirement in kWh/m²/year	27.21	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1958.52	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2056.45	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2045.87	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2148.16	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	42.05	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.58	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	46.58	(331)

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Energy for lighting (calculated in Appendix L)				317.84	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	976.56	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	21.82	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	998.38	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				998.38	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	24.17	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	164.96	(379)
Total CO2, kg/year	sum of (376)…(382) =				1187.51	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				16.5	(384)
EI rating (section 14)					86.4	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-3-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.98	(1a) x	2.4	(2a) =	172.75	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.98	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	172.75	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.69	x1/[1/(1.4)+ 0.04]		=	6.22			(27)
Windows Type 2			4.69	x1/[1/(1.4)+ 0.04]		=	6.22			(27)
Windows Type 3			2.45	x1/[1/(1.4)+ 0.04]		=	3.25			(27)
Windows Type 4			2.45	x1/[1/(1.4)+ 0.04]		=	3.25			(27)
Windows Type 5			1.63	x1/[1/(1.4)+ 0.04]		=	2.16			(27)
Walls Type1	41.71	15.91	25.8	x	0.18	=	4.64			(29)
Walls Type2	11.24	2.1	9.14	x	0.18	=	1.65			(29)
Total area of elements, m²			52.95							(31)
Party wall			43.65	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	29.48	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		4.98	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	34.46	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	34.51	34.28	34.05	32.98	32.78	31.84	31.84	31.67	32.2	32.78	33.18	33.61	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	68.98	68.74	68.51	67.44	67.24	66.3	66.3	66.13	66.66	67.24	67.65	68.07	

Average = Sum(39)$_{1\ldots12}$ /12= 67.44 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.96	0.96	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.95	

Average = Sum(40)$_{1\ldots12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.29 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.66 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	97.53	93.98	90.44	86.89	83.34	79.8	79.8	83.34	86.89	90.44	93.98	97.53	

Total = Sum(44)$_{1\ldots12}$ = 1063.97 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.63	126.5	130.54	113.8	109.2	94.23	87.32	100.2	101.39	118.17	128.99	140.07	

Total = Sum(45)$_{1\ldots12}$ = 1395.03 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.7	18.97	19.58	17.07	16.38	14.13	13.1	15.03	15.21	17.72	19.35	21.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.23	168.58	177.13	158.9	155.79	139.32	133.91	146.79	146.49	164.76	174.08	186.67	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.23	168.58	177.13	158.9	155.79	139.32	133.91	146.79	146.49	164.76	174.08	186.67	

Output from water heater (annual)$_{1...12}$	1943.65	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.37	75.73	80.68	73.91	73.58	67.4	66.31	70.59	69.79	76.57	78.96	83.85	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18	15.99	13	9.84	7.36	6.21	6.71	8.73	11.71	14.87	17.36	18.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	201.87	203.97	198.69	187.45	173.27	159.93	151.03	148.93	154.21	165.45	179.63	192.97	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	(71)

Water heating gains (Table 5)

(72)m=	114.74	112.69	108.44	102.66	98.9	93.62	89.12	94.88	96.93	102.91	109.67	112.7	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	395.01	393.05	380.53	360.35	339.93	320.16	307.26	312.93	323.24	343.63	367.06	384.57	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.69	x	10.63	x	0.63	x	0.7	=	15.24	(74)
North	0.9x	0.77	x	2.45	x	10.63	x	0.63	x	0.7	=	7.96	(74)

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North	0.9x	0.77	x	2.45	x	10.63	x	0.63	x	0.7	=	7.96	(74)
North	0.9x	0.77	x	1.63	x	10.63	x	0.63	x	0.7	=	5.3	(74)
North	0.9x	0.77	x	4.69	x	20.32	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.45	x	20.32	x	0.63	x	0.7	=	15.22	(74)
North	0.9x	0.77	x	2.45	x	20.32	x	0.63	x	0.7	=	15.22	(74)
North	0.9x	0.77	x	1.63	x	20.32	x	0.63	x	0.7	=	10.12	(74)
North	0.9x	0.77	x	4.69	x	34.53	x	0.63	x	0.7	=	49.49	(74)
North	0.9x	0.77	x	2.45	x	34.53	x	0.63	x	0.7	=	25.85	(74)
North	0.9x	0.77	x	2.45	x	34.53	x	0.63	x	0.7	=	25.85	(74)
North	0.9x	0.77	x	1.63	x	34.53	x	0.63	x	0.7	=	17.2	(74)
North	0.9x	0.77	x	4.69	x	55.46	x	0.63	x	0.7	=	79.5	(74)
North	0.9x	0.77	x	2.45	x	55.46	x	0.63	x	0.7	=	41.53	(74)
North	0.9x	0.77	x	2.45	x	55.46	x	0.63	x	0.7	=	41.53	(74)
North	0.9x	0.77	x	1.63	x	55.46	x	0.63	x	0.7	=	27.63	(74)
North	0.9x	0.77	x	4.69	x	74.72	x	0.63	x	0.7	=	107.09	(74)
North	0.9x	0.77	x	2.45	x	74.72	x	0.63	x	0.7	=	55.94	(74)
North	0.9x	0.77	x	2.45	x	74.72	x	0.63	x	0.7	=	55.94	(74)
North	0.9x	0.77	x	1.63	x	74.72	x	0.63	x	0.7	=	37.22	(74)
North	0.9x	0.77	x	4.69	x	79.99	x	0.63	x	0.7	=	114.65	(74)
North	0.9x	0.77	x	2.45	x	79.99	x	0.63	x	0.7	=	59.89	(74)
North	0.9x	0.77	x	2.45	x	79.99	x	0.63	x	0.7	=	59.89	(74)
North	0.9x	0.77	x	1.63	x	79.99	x	0.63	x	0.7	=	39.84	(74)
North	0.9x	0.77	x	4.69	x	74.68	x	0.63	x	0.7	=	107.04	(74)
North	0.9x	0.77	x	2.45	x	74.68	x	0.63	x	0.7	=	55.91	(74)
North	0.9x	0.77	x	2.45	x	74.68	x	0.63	x	0.7	=	55.91	(74)
North	0.9x	0.77	x	1.63	x	74.68	x	0.63	x	0.7	=	37.2	(74)
North	0.9x	0.77	x	4.69	x	59.25	x	0.63	x	0.7	=	84.92	(74)
North	0.9x	0.77	x	2.45	x	59.25	x	0.63	x	0.7	=	44.36	(74)
North	0.9x	0.77	x	2.45	x	59.25	x	0.63	x	0.7	=	44.36	(74)
North	0.9x	0.77	x	1.63	x	59.25	x	0.63	x	0.7	=	29.51	(74)
North	0.9x	0.77	x	4.69	x	41.52	x	0.63	x	0.7	=	59.51	(74)
North	0.9x	0.77	x	2.45	x	41.52	x	0.63	x	0.7	=	31.09	(74)
North	0.9x	0.77	x	2.45	x	41.52	x	0.63	x	0.7	=	31.09	(74)
North	0.9x	0.77	x	1.63	x	41.52	x	0.63	x	0.7	=	20.68	(74)
North	0.9x	0.77	x	4.69	x	24.19	x	0.63	x	0.7	=	34.67	(74)
North	0.9x	0.77	x	2.45	x	24.19	x	0.63	x	0.7	=	18.11	(74)
North	0.9x	0.77	x	2.45	x	24.19	x	0.63	x	0.7	=	18.11	(74)
North	0.9x	0.77	x	1.63	x	24.19	x	0.63	x	0.7	=	12.05	(74)
North	0.9x	0.77	x	4.69	x	13.12	x	0.63	x	0.7	=	18.8	(74)
North	0.9x	0.77	x	2.45	x	13.12	x	0.63	x	0.7	=	9.82	(74)
North	0.9x	0.77	x	2.45	x	13.12	x	0.63	x	0.7	=	9.82	(74)

North	0.9x	0.77	x	1.63	x	13.12	x	0.63	x	0.7	=	6.53	(74)
North	0.9x	0.77	x	4.69	x	8.86	x	0.63	x	0.7	=	12.71	(74)
North	0.9x	0.77	x	2.45	x	8.86	x	0.63	x	0.7	=	6.64	(74)
North	0.9x	0.77	x	2.45	x	8.86	x	0.63	x	0.7	=	6.64	(74)
North	0.9x	0.77	x	1.63	x	8.86	x	0.63	x	0.7	=	4.42	(74)
East	0.9x	1	x	4.69	x	19.64	x	0.63	x	0.7	=	28.15	(76)
East	0.9x	1	x	4.69	x	38.42	x	0.63	x	0.7	=	55.07	(76)
East	0.9x	1	x	4.69	x	63.27	x	0.63	x	0.7	=	90.69	(76)
East	0.9x	1	x	4.69	x	92.28	x	0.63	x	0.7	=	132.27	(76)
East	0.9x	1	x	4.69	x	113.09	x	0.63	x	0.7	=	162.1	(76)
East	0.9x	1	x	4.69	x	115.77	x	0.63	x	0.7	=	165.94	(76)
East	0.9x	1	x	4.69	x	110.22	x	0.63	x	0.7	=	157.98	(76)
East	0.9x	1	x	4.69	x	94.68	x	0.63	x	0.7	=	135.7	(76)
East	0.9x	1	x	4.69	x	73.59	x	0.63	x	0.7	=	105.48	(76)
East	0.9x	1	x	4.69	x	45.59	x	0.63	x	0.7	=	65.34	(76)
East	0.9x	1	x	4.69	x	24.49	x	0.63	x	0.7	=	35.1	(76)
East	0.9x	1	x	4.69	x	16.15	x	0.63	x	0.7	=	23.15	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	64.61	124.75	209.09	322.45	418.3	440.2	414.04	338.86	247.84	148.29	80.08	53.55	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	459.63	517.8	589.62	682.8	758.22	760.37	721.3	651.79	571.08	491.92	447.14	438.11	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.76	0.55	0.4	0.46	0.75	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.2	20.44	20.75	20.94	20.99	21	21	20.96	20.69	20.33	20.04	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.12	20.12	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.13	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.71	0.48	0.33	0.38	0.68	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.86	19.07	19.41	19.85	20.08	20.14	20.15	20.15	20.11	19.79	19.26	18.84	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.34	19.52	19.82	20.21	20.42	20.48	20.49	20.49	20.45	20.15	19.69	19.32	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.34	19.52	19.82	20.21	20.42	20.48	20.49	20.49	20.45	20.15	19.69	19.32	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.73	0.51	0.36	0.41	0.71	0.94	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	457.4	512.54	572.68	613.6	551.93	386.67	257.52	269.66	402.64	463.99	442.41	436.47	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1037.65	1004.93	912.75	762.48	586.5	390.11	257.86	270.44	423.38	641.99	851.54	1029.45	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	431.71	330.88	253.01	107.19	25.72	0	0	0	0	132.44	294.57	441.18

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2016.69 (98)

Space heating requirement in kWh/m²/year 28.02 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	431.71	330.88	253.01	107.19	25.72	0	0	0	0	132.44	294.57	441.18	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	461.72	353.88	270.6	114.64	27.51	0	0	0	0	141.64	315.05	471.85	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2156.88 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

191.23	168.58	177.13	158.9	155.79	139.32	133.91	146.79	146.49	164.76	174.08	186.67

Efficiency of water heater 79.8 (216)

(217)m=	86.92	86.58	85.76	83.79	81.16	79.8	79.8	79.8	79.8	84.24	86.21	87.03	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	220	194.71	206.53	189.63	191.96	174.59	167.81	183.95	183.57	195.59	201.93	214.48

Total = Sum(219a)$_{1...12}$ = 2324.75 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2156.88
Water heating fuel used		2324.75
Electricity for pumps, fans and electric keep-hot		

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central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			317.9	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	465.89	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	502.15	(264)
Space and water heating	(261) + (262) + (263) + (264) =			968.03	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	164.99	(268)
Total CO2, kg/year		sum of (265)…(271) =		1171.95	(272)

TER = 16.28 (273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-3-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.81	(1a) x	2.4	(2a) =	121.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.81	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	17.04	7.36	9.68	x	0.18	=	1.74			(29)
Walls Type2	19.18	2.1	17.08	x	0.18	=	3.07			(29)
Total area of elements, m²			36.22							(31)
Party wall			33.09	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	15.76	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		6.86	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	22.62	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	42.74	42.74	42.74	42.74	42.74	42.74	42.74	42.74	42.74	42.74	42.74	42.74	

Average = Sum(39)$_{1…12}$ /12= 42.74 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84

Average = Sum(40)$_{1…12}$ /12= 0.84 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.91 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.4	79.4	76.4	73.41	70.41	67.42	67.42	70.41	73.41	76.4	79.4	82.4	
										Total = Sum(44)$_{1…12}$ =		898.88	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	122.19	106.87	110.28	96.15	92.25	79.61	73.77	84.65	85.66	99.83	108.97	118.34	
										Total = Sum(45)$_{1…12}$ =		1178.57	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.33	16.03	16.54	14.42	13.84	11.94	11.07	12.7	12.85	14.97	16.35	17.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	177.47	156.8	165.56	149.64	147.53	133.1	129.05	139.93	139.16	155.11	162.47	173.61	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	177.47	156.8	165.56	149.64	147.53	133.1	129.05	139.93	139.16	155.11	162.47	173.61	

Output from water heater (annual)$_{1...12}$ 1829.41 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.85	75.48	80.89	74.76	74.9	69.26	68.75	72.37	71.28	77.42	79.03	83.57	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.8	12.26	9.97	7.55	5.64	4.76	5.15	6.69	8.98	11.4	13.3	14.18	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	149.34	150.89	146.98	138.67	128.17	118.31	111.72	110.17	114.08	122.39	132.89	142.75	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	(71)

Water heating gains (Table 5)

(72)m=	114.05	112.32	108.72	103.84	100.67	96.2	92.41	97.27	99	104.05	109.76	112.32	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	325.89	324.17	314.38	298.76	283.19	267.98	257.98	262.84	270.76	286.55	304.66	317.96	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)

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East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	40.07	78.39	129.09	188.27	230.73	236.19	224.87	193.16	150.14	93.01	49.96	32.95	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	365.96	402.55	443.47	487.03	513.92	504.18	482.85	456	420.9	379.56	354.62	350.91	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.89	0.73	0.54	0.39	0.43	0.68	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.31	20.43	20.62	20.84	20.96	21	21	21	20.98	20.82	20.52	20.28	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.86	0.68	0.47	0.32	0.36	0.61	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.31	19.47	19.75	20.04	20.18	20.21	20.22	20.22	20.2	20.02	19.61	19.25	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.81	19.95	20.19	20.44	20.57	20.61	20.61	20.61	20.59	20.42	20.06	19.77	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.81	19.95	20.19	20.44	20.57	20.61	20.61	20.61	20.59	20.42	20.06	19.77	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.87	0.71	0.51	0.35	0.39	0.64	0.91	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	362.48	395.2	423.23	424.73	363.89	255.12	171.22	179.63	270.96	343.89	347.36	348.31	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	663	643.43	585.06	493.15	379.23	256.69	171.35	179.88	277.55	419.62	554.14	665.36	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	223.59	166.81	120.4	49.27	11.41	0	0	0	0	56.34	148.88	235.89	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1012.6 (98)

Space heating requirement in kWh/m²/year 19.93 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1012.6	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1063.23	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1829.41	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1920.89	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	29.84	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		32.88	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			32.88	(331)
Energy for lighting (calculated in Appendix L)				243.69	(332)

12b. CO_2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	693.08	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	15.49	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	708.57	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				708.57	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	17.06	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	126.47	(379)
Total CO2, kg/year	sum of (376)…(382) =				852.11	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				16.77	(384)
EI rating (section 14)					88.08	(385)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version: Version: 1.0.4.8

Property Address: b2-3-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.81	(1a) x	2.4	(2a) =	121.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.81	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	17.04	7.36	9.68	x	0.18	=	1.74			(29)
Walls Type2	19.18	2.1	17.08	x	0.18	=	3.07			(29)
Total area of elements, m²			36.22							(31)
Party wall			33.09	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.67 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.27 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 19.94 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	24.17	24.01	23.86	23.14	23	22.37	22.37	22.25	22.61	23	23.27	23.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	44.11	43.95	43.8	43.08	42.94	42.31	42.31	42.19	42.55	42.94	43.21	43.5	

Average = Sum(39)$_{1…12}$ /12= 43.08 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.87	0.87	0.86	0.85	0.85	0.83	0.83	0.83	0.84	0.85	0.85	0.86	

Average = Sum(40)$_{1…12}$ /12= 0.85 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.91 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	82.4	79.4	76.4	73.41	70.41	67.42	67.42	70.41	73.41	76.4	79.4	82.4	

Total = Sum(44)$_{1…12}$ = 898.88 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.19	106.87	110.28	96.15	92.25	79.61	73.77	84.65	85.66	99.83	108.97	118.34	

Total = Sum(45)$_{1…12}$ = 1178.57 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.33	16.03	16.54	14.42	13.84	11.94	11.07	12.7	12.85	14.97	16.35	17.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.79	148.96	156.88	141.24	138.85	124.7	120.36	131.25	130.75	146.43	154.06	164.93	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.79	148.96	156.88	141.24	138.85	124.7	120.36	131.25	130.75	146.43	154.06	164.93	

Output from water heater (annual)$_{1...12}$ 1727.19 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.91	69.2	73.94	68.04	67.95	62.54	61.8	65.42	64.56	70.47	72.31	76.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	14.18	12.59	10.24	7.75	5.8	4.89	5.29	6.87	9.22	11.71	13.67	14.57	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	149.34	150.89	146.98	138.67	128.17	118.31	111.72	110.17	114.08	122.39	132.89	142.75	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	(71)
Water heating gains (Table 5)													
(72)m=	104.71	102.98	99.39	94.5	91.33	86.87	83.07	87.93	89.66	94.72	100.43	102.99	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	319.94	318.17	308.32	292.63	277.01	261.78	251.79	256.69	264.67	280.53	298.69	312.02	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(76)

East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	44.18	86.42	142.32	207.57	254.38	260.4	247.92	212.96	165.53	102.54	55.08	36.33	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	364.11	404.59	450.64	500.2	531.39	522.18	499.7	469.64	430.2	383.07	353.77	348.35	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.88	0.72	0.52	0.37	0.41	0.66	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.4	20.61	20.84	20.97	21	21	21	20.98	20.82	20.51	20.25	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.19	20.2	20.2	20.21	20.21	20.23	20.23	20.23	20.22	20.21	20.21	20.2	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.85	0.67	0.45	0.31	0.34	0.6	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.22	19.41	19.71	20.04	20.18	20.22	20.22	20.23	20.21	20.02	19.58	19.2	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.75	19.91	20.16	20.44	20.57	20.61	20.61	20.61	20.6	20.42	20.04	19.73	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(93)m=	19.75	19.91	20.16	20.44	20.57	20.61	20.61	20.61	20.6	20.42	20.04	19.73		(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.98	0.95	0.86	0.69	0.48	0.34	0.38	0.63	0.9	0.98	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	360.88	397.38	429.79	431.85	367.44	253.11	169.67	177.58	270.74	346.27	346.75	345.91		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	681.42	659.61	598.38	497.21	381.08	254.27	169.76	177.76	276.46	421.53	559.4	675.45		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	238.48	176.22	125.43	47.06	10.15	0	0	0	0	55.99	153.11	245.18		
									Total per year (kWh/year) = Sum(98)1...5,9...12 =				1051.63	(98)
Space heating requirement in kWh/m²/year													20.7	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	238.48	176.22	125.43	47.06	10.15	0	0	0	0	55.99	153.11	245.18		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	255.06	188.47	134.15	50.33	10.86	0	0	0	0	59.89	163.75	262.22		
									Total (kWh/year) =Sum(211)1...5,10...12=				1124.73	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
									Total (kWh/year) =Sum(215)1...5,10...12=				0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)														
	168.79	148.96	156.88	141.24	138.85	124.7	120.36	131.25	130.75	146.43	154.06	164.93		
Efficiency of water heater													79.8	(216)
(217)m=	85.74	85.26	84.22	82.23	80.45	79.8	79.8	79.8	79.8	82.5	84.8	85.87		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	196.87	174.7	186.26	171.76	172.59	156.27	150.83	164.47	163.85	177.49	181.69	192.07		
									Total = Sum(219a)1...12 =				2088.85	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1124.73

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Water heating fuel used			2088.85	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			250.39	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	242.94	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	451.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =			694.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	129.95	(268)
Total CO2, kg/year		sum of (265)…(271) =		863.01	(272)
TER =				16.99	(273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-3-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.09	(1a) x	2.4	(2a) =	177.82	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.09	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	177.82	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	31	12.88	18.12	x	0.18	=	3.26			(29)
Walls Type2	31.26	2.1	29.16	x	0.18	=	5.25			(29)
Total area of elements, m²			62.26							(31)
Party wall			31.88	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	25.78	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		10.15	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	35.93	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	65.27	65.27	65.27	65.27	65.27	65.27	65.27	65.27	65.27	65.27	65.27	65.27	

Average = Sum(39)$_{1…12}$ /12= 65.27 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88

Average = Sum(40)$_{1...12}$ /12= 0.88 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.34 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.8 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.78	95.19	91.6	88.01	84.42	80.82	80.82	84.42	88.01	91.6	95.19	98.78	
									Total = Sum(44)$_{1...12}$ =			1077.64	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	146.49	128.12	132.21	115.27	110.6	95.44	88.44	101.49	102.7	119.68	130.64	141.87	
									Total = Sum(45)$_{1...12}$ =			1412.96	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	21.97	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.4	17.95	19.6	21.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.77	178.05	187.49	168.76	165.88	148.93	143.72	156.76	156.19	174.96	184.14	197.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.77	178.05	187.49	168.76	165.88	148.93	143.72	156.76	156.19	174.96	184.14	197.15	

Output from water heater (annual)$_{1...12}$ 2063.8 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.93	82.54	88.18	81.12	81	74.53	73.63	77.97	76.94	84.02	86.23	91.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.57	16.49	13.41	10.15	7.59	6.41	6.92	9	12.08	15.34	17.9	19.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	206.65	208.79	203.39	191.89	177.36	163.72	154.6	152.45	157.86	169.36	183.88	197.53	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	(71)

Water heating gains (Table 5)

(72)m=	124.91	122.83	118.52	112.67	108.87	103.51	98.96	104.79	106.86	112.93	119.77	122.84	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	408.24	406.23	393.44	372.82	351.94	331.75	318.6	324.36	334.92	355.74	379.67	397.57	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.6	x	10.63	x	0.5	x	0.8	=	13.56	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.5	x	0.8	=	25.91	(74)
North	0.9x	0.77	x	4.6	x	34.53	x	0.5	x	0.8	=	44.03	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.5	x	0.8	=	70.72	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.5	x	0.8	=	95.27	(74)

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North	0.9x	0.77	x	4.6	x	79.99	x	0.5	x	0.8	=	101.99	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.5	x	0.8	=	95.22	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.5	x	0.8	=	75.55	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.5	x	0.8	=	52.94	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.5	x	0.8	=	30.84	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.5	x	0.8	=	16.73	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.5	x	0.8	=	11.3	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	58.64	114.1	189.26	282.53	354.84	367.71	348.2	292.85	221.84	135.48	72.93	48.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	466.88	520.33	582.7	655.35	706.78	699.46	666.8	617.21	556.76	491.22	452.6	445.95	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.79	0.59	0.43	0.48	0.76	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.17	20.29	20.5	20.76	20.93	20.99	21	21	20.96	20.72	20.39	20.13	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.74	0.52	0.35	0.4	0.69	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.07	19.24	19.55	19.91	20.12	20.18	20.18	20.18	20.15	19.87	19.39	19.02	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.51	19.66	19.93	20.25	20.45	20.5	20.51	20.51	20.48	20.21	19.79	19.46	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.51	19.66	19.93	20.25	20.45	20.5	20.51	20.51	20.48	20.21	19.79	19.46	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.91	0.76	0.54	0.38	0.43	0.71	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	464.66	515.2	566.68	595.68	534.26	381.09	254.79	267.36	396.86	463.41	447.86	444.33	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	992.62	963.5	876.56	740.64	570.93	385.3	255.18	268.18	416.24	627.21	828.37	996.14	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	392.8	301.26	230.55	104.37	27.28	0	0	0	0	121.87	273.97	410.55	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1862.65 | (98)

Space heating requirement in kWh/m²/year | 25.14 | (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

DER WorkSheet: New dwelling design stage

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1862.65	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1955.78	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2063.8	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2166.99	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	41.23	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.94	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	47.94	(331)
Energy for lighting (calculated in Appendix L)		327.88	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	957.55	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	21.4	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	978.94	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				978.94	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	24.88	(378)

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CO2 associated with electricity for lighting	(332))) x	0.52	=	170.17	(379)
Total CO2, kg/year	sum of (376)…(382) =			1173.99	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.85	(384)
EI rating (section 14)				86.79	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-3-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.09	(1a) x	2.4	(2a) =	177.82	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.09	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	177.82	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	31	12.88	18.12	x	0.18	=	3.26			(29)
Walls Type2	31.26	2.1	29.16	x	0.18	=	5.25			(29)
Total area of elements, m²			62.26							(31)
Party wall			31.88	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 27.69 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.93 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 32.61 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.38	35.15	34.92	33.84	33.63	32.69	32.69	32.52	33.06	33.63	34.04	34.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	67.99	67.76	67.53	66.45	66.25	65.31	65.31	65.13	65.67	66.25	66.66	67.08	

Average = Sum(39)$_{1…12}$ /12= 66.45 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.92	0.91	0.91	0.9	0.89	0.88	0.88	0.88	0.89	0.89	0.9	0.91

Average = Sum(40)$_{1…12}$ /12= 0.9 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.34 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.8 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.78	95.19	91.6	88.01	84.42	80.82	80.82	84.42	88.01	91.6	95.19	98.78	
										Total = Sum(44)$_{1…12}$ =		1077.64	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	146.49	128.12	132.21	115.27	110.6	95.44	88.44	101.49	102.7	119.68	130.64	141.87	
										Total = Sum(45)$_{1…12}$ =		1412.96	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	21.97	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.4	17.95	19.6	21.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	193.09	170.21	178.81	160.36	157.2	140.53	135.03	148.08	147.79	166.28	175.74	188.47	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	193.09	170.21	178.81	160.36	157.2	140.53	135.03	148.08	147.79	166.28	175.74	188.47	

Output from water heater (annual)$_{1...12}$ 1961.57 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.98	76.27	81.24	74.4	74.05	67.81	66.68	71.02	70.22	77.07	79.51	84.45	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	18.93	16.81	13.67	10.35	7.74	6.53	7.06	9.17	12.31	15.63	18.25	19.45	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	206.65	208.79	203.39	191.89	177.36	163.72	154.6	152.45	157.86	169.36	183.88	197.53	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	(71)
Water heating gains (Table 5)													
(72)m=	115.57	113.5	109.19	103.33	99.53	94.18	89.63	95.46	97.53	103.59	110.43	113.51	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	402.26	400.22	387.37	366.69	345.75	325.54	312.4	318.2	328.82	349.7	373.68	391.61	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.6	x	10.63	x	0.63	x	0.7	=	14.95	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.63	x	0.7	=	28.57	(74)
North	0.9x	0.77	x	4.6	x	34.53	x	0.63	x	0.7	=	48.54	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.63	x	0.7	=	77.97	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.63	x	0.7	=	105.04	(74)

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North	0.9x	0.77	x	4.6	x	79.99	x	0.63	x	0.7	=	112.44	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.63	x	0.7	=	104.98	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.63	x	0.7	=	83.29	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.63	x	0.7	=	58.36	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.63	x	0.7	=	34.01	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.63	x	0.7	=	18.44	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.63	x	0.7	=	12.46	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

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East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	64.65	125.79	208.65	311.49	391.22	405.4	383.89	322.86	244.58	149.37	80.41	53.33	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	466.91	526.01	596.02	678.17	736.96	730.94	696.29	641.07	573.4	499.07	454.09	444.94	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.77	0.56	0.41	0.47	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.25	20.48	20.76	20.94	20.99	21	21	20.96	20.72	20.37	20.09	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.16	20.16	20.17	20.17	20.18	20.18	20.19	20.18	20.17	20.17	20.16	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.72	0.5	0.34	0.38	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.96	19.16	19.49	19.9	20.12	20.18	20.18	20.18	20.15	19.85	19.35	18.94	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.42	19.6	19.89	20.24	20.45	20.5	20.51	20.51	20.48	20.2	19.76	19.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.42	19.6	19.89	20.24	20.45	20.5	20.51	20.51	20.48	20.2	19.76	19.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.9	0.74	0.52	0.37	0.42	0.7	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	464.75	520.77	579	611.4	545.26	382.21	255.01	267.04	400.96	469.91	449.38	443.36	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1028.36	995.8	904.03	753.85	579.34	385.59	255.31	267.7	418.78	635.92	843.65	1019.95	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	419.32	319.22	241.83	102.57	25.35	0	0	0	0	123.51	283.88	428.98	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = | 1944.66 | (98)

Space heating requirement in kWh/m²/year | 26.25 | (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system | 0 | (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	419.32	319.22	241.83	102.57	25.35	0	0	0	0	123.51	283.88	428.98		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	448.48	341.42	258.64	109.7	27.11	0	0	0	0	132.09	303.61	458.8		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2079.85	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	193.09	170.21	178.81	160.36	157.2	140.53	135.03	148.08	147.79	166.28	175.74	188.47		
Efficiency of water heater													79.8	(216)
(217)m=	86.83	86.47	85.62	83.66	81.13	79.8	79.8	79.8	79.8	84.03	86.09	86.94		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	222.38	196.85	208.84	191.68	193.75	176.1	169.22	185.56	185.2	197.87	204.14	216.77		
Total = Sum(219a)$_{1...12}$ =													2348.36	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2079.85	
Water heating fuel used			2348.36	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			334.23	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	449.25	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	507.25	(264)
Space and water heating	(261) + (262) + (263) + (264) =				956.49	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	173.47	(268)

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Total CO2, kg/year	sum of (265)…(271) =	1168.89	(272)
TER =		15.78	(273)

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DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-3-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	75.18	(1a) x	2.4	(2a) =	180.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.18	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	180.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Walls Type1	41.41	15.41	26	x	0.18	=	4.68			(29)
Walls Type2	4.86	2.1	2.76	x	0.18	=	0.5			(29)
Total area of elements, m²			46.27							(31)
Party wall			42	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.34 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.45 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 34.79 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.56	64.56	64.56	64.56	64.56	64.56	64.56	64.56	64.56	64.56	64.56	64.56	

Average = Sum(39)$_{1…12}$ /12= 64.56 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86

Average = Sum(40)$_{1...12}$ /12= 0.86 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.37 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.37 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	99.41	95.79	92.18	88.56	84.95	81.33	81.33	84.95	88.56	92.18	95.79	99.41

Total = Sum(44)$_{1...12}$ = 1084.44 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.42	128.93	133.05	115.99	111.3	96.04	89	102.13	103.35	120.44	131.47	142.77

Total = Sum(45)$_{1...12}$ = 1421.87 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.11	19.34	19.96	17.4	16.69	14.41	13.35	15.32	15.5	18.07	19.72	21.41	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.69	178.86	188.32	169.49	166.58	149.54	144.27	157.4	156.84	175.72	184.96	198.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.69	178.86	188.32	169.49	166.58	149.54	144.27	157.4	156.84	175.72	184.96	198.04	

Output from water heater (annual)$_{1...12}$ 2072.71 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.24	82.81	88.46	81.36	81.23	74.73	73.81	78.18	77.16	84.27	86.51	91.69	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.64	16.56	13.46	10.19	7.62	6.43	6.95	9.03	12.13	15.4	17.97	19.16	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	209.07	211.24	205.78	194.14	179.44	165.64	156.41	154.24	159.71	171.35	186.04	199.85	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	(71)

Water heating gains (Table 5)

(72)m=	125.32	123.23	118.9	113	109.18	103.79	99.21	105.08	107.16	113.26	120.15	123.24	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.51	409.51	396.61	375.81	354.72	334.33	321.05	326.83	337.47	358.48	382.64	400.72	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(76)
East	0.9x	1	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(76)
East	0.9x	1	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(76)
East	0.9x	1	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(76)
East	0.9x	1	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(76)

East	0.9x	1	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(76)
East	0.9x	1	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(76)
East	0.9x	1	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(76)
East	0.9x	1	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(76)
East	0.9x	1	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(76)
East	0.9x	1	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(76)
East	0.9x	1	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)

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South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	159.95	271.13	366.39	444.56	488.08	479.88	464.62	433.09	393.73	298.53	191.37	137.01	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	571.46	680.64	763	820.36	842.8	814.22	785.67	759.92	731.2	657.01	574.01	537.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.84	0.69	0.5	0.36	0.39	0.6	0.87	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.33	20.5	20.71	20.88	20.97	21	21	21	20.99	20.87	20.56	20.27	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.81	0.64	0.44	0.3	0.32	0.53	0.84	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.31	19.57	19.85	20.08	20.18	20.2	20.2	20.2	20.2	20.07	19.65	19.24	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.72	19.94	20.19	20.4	20.5	20.52	20.52	20.52	20.51	20.39	20.01	19.65	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.72	19.94	20.19	20.4	20.5	20.52	20.52	20.52	20.51	20.39	20.01	19.65	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.82	0.66	0.47	0.32	0.35	0.56	0.85	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	564.33	658.01	701.53	670.96	552.15	380.52	253.05	265.87	409.26	556.75	556.41	532.91	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	995.36	971.22	884.01	742.33	567.85	382.14	253.18	266.08	414.08	632.08	833.52	997.65	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	320.69	210.48	135.77	51.39	11.68	0	0	0	0	56.04	199.51	345.77	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1331.33 (98)

Space heating requirement in kWh/m²/year 17.71 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1331.33	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1397.9	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2072.71	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2176.35	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	35.74	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		48.65	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	48.65	(331)
Energy for lighting (calculated in Appendix L)		329.17	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	830.15	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	18.55	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	848.7	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				848.7	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	25.25	(378)

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CO2 associated with electricity for lighting	(332))) x	0.52	=	170.84	(379)
Total CO2, kg/year	sum of (376)…(382) =			1044.79	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			13.9	(384)
EI rating (section 14)				88.35	(385)

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User Details:

Assessor Name: | **Stroma Number:**

Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-3-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	75.18	(1a) x	2.4	(2a) =	180.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.18	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		180.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Walls Type1	41.41	15.41	26	x	0.18	=	4.68			(29)
Walls Type2	4.86	2.1	2.76	x	0.18	=	0.5			(29)
Total area of elements, m²			46.27							(31)
Party wall			42	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 27.71 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.13 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 31.84 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.83	35.6	35.36	34.28	34.08	33.14	33.14	32.96	33.5	34.08	34.49	34.92	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	67.67	67.44	67.21	66.12	65.92	64.98	64.98	64.8	65.34	65.92	66.33	66.76	

Average = Sum(39)$_{1…12}$ /12= 66.12 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.9	0.9	0.89	0.88	0.88	0.86	0.86	0.86	0.87	0.88	0.88	0.89

Average = Sum(40)$_{1...12}$ /12= 0.88 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.37 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.37 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	99.41	95.79	92.18	88.56	84.95	81.33	81.33	84.95	88.56	92.18	95.79	99.41

Total = Sum(44)$_{1...12}$ = 1084.44 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.42	128.93	133.05	115.99	111.3	96.04	89	102.13	103.35	120.44	131.47	142.77

Total = Sum(45)$_{1...12}$ = 1421.87 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.11	19.34	19.96	17.4	16.69	14.41	13.35	15.32	15.5	18.07	19.72	21.41	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	194.01	171.02	179.64	161.09	157.89	141.13	135.59	148.72	148.44	167.03	176.56	189.36	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	194.01	171.02	179.64	161.09	157.89	141.13	135.59	148.72	148.44	167.03	176.56	189.36	

Output from water heater (annual)$_{1...12}$ 1970.49 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.29	76.54	81.51	74.64	74.28	68.01	66.87	71.23	70.44	77.32	79.79	84.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.73	16.63	13.53	10.24	7.65	6.46	6.98	9.08	12.18	15.47	18.05	19.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	209.07	211.24	205.78	194.14	179.44	165.64	156.41	154.24	159.71	171.35	186.04	199.85	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	(71)

Water heating gains (Table 5)

(72)m=	115.98	113.9	109.56	103.67	99.84	94.45	89.88	95.74	97.83	103.93	110.81	113.91	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	405.26	403.25	390.34	369.52	348.42	328.03	314.75	320.54	331.2	352.22	376.39	394.48	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.29	x	19.64	x	0.63	x	0.7	=	31.75	(76)
East	0.9x	1	x	5.29	x	38.42	x	0.63	x	0.7	=	62.11	(76)
East	0.9x	1	x	5.29	x	63.27	x	0.63	x	0.7	=	102.29	(76)
East	0.9x	1	x	5.29	x	92.28	x	0.63	x	0.7	=	149.19	(76)
East	0.9x	1	x	5.29	x	113.09	x	0.63	x	0.7	=	182.84	(76)

East	0.9x	1	x	5.29	x	115.77	x	0.63	x	0.7	=	187.17	(76)
East	0.9x	1	x	5.29	x	110.22	x	0.63	x	0.7	=	178.19	(76)
East	0.9x	1	x	5.29	x	94.68	x	0.63	x	0.7	=	153.06	(76)
East	0.9x	1	x	5.29	x	73.59	x	0.63	x	0.7	=	118.97	(76)
East	0.9x	1	x	5.29	x	45.59	x	0.63	x	0.7	=	73.7	(76)
East	0.9x	1	x	5.29	x	24.49	x	0.63	x	0.7	=	39.59	(76)
East	0.9x	1	x	5.29	x	16.15	x	0.63	x	0.7	=	26.11	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.63	x	0.7	=	65.72	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.63	x	0.7	=	107.64	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.63	x	0.7	=	137.12	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.63	x	0.7	=	154.97	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.63	x	0.7	=	161.49	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.63	x	0.7	=	155.41	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.63	x	0.7	=	151.85	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.63	x	0.7	=	147.46	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.63	x	0.7	=	143.23	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.63	x	0.7	=	116.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.63	x	0.7	=	77.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)

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South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.63	x	0.7	=	56.79	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	176.35	298.92	403.95	490.12	538.11	529.07	512.25	477.48	434.08	329.12	210.99	151.05	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	581.61	702.17	794.29	859.64	886.53	857.1	826.99	798.02	765.28	681.34	587.37	545.53	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.93	0.83	0.67	0.48	0.35	0.37	0.58	0.87	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.28	20.47	20.69	20.89	20.97	21	21	21	20.99	20.87	20.54	20.24	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.17	20.18	20.19	20.2	20.2	20.2	20.19	20.19	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.79	0.62	0.42	0.28	0.31	0.52	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.21	19.5	19.8	20.06	20.16	20.2	20.2	20.2	20.19	20.06	19.61	19.17	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.64	19.89	20.16	20.39	20.49	20.52	20.52	20.52	20.51	20.38	19.98	19.6	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.64	19.89	20.16	20.39	20.49	20.52	20.52	20.52	20.51	20.38	19.98	19.6	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.91	0.8	0.64	0.45	0.31	0.33	0.54	0.84	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	574.2	677.65	726.57	691.08	564.78	383.14	254.52	266.8	414.55	570.86	568.47	540.48	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1037.92	1010.8	918.01	759.9	579.31	384.44	254.62	266.96	418.78	644.94	854.52	1027.89	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	345	223.88	142.43	49.55	10.81	0	0	0	0	55.11	205.96	362.63	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1395.37 | (98)

Space heating requirement in kWh/m²/year | 18.56 | (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system | 0 | (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	345	223.88	142.43	49.55	10.81	0	0	0	0	55.11	205.96	362.63		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	368.99	239.44	152.33	52.99	11.56	0	0	0	0	58.94	220.28	387.84		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1492.38	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	194.01	171.02	179.64	161.09	157.89	141.13	135.59	148.72	148.44	167.03	176.56	189.36		
Efficiency of water heater													79.8	(216)
(217)m=	86.33	85.53	84.2	82.08	80.41	79.8	79.8	79.8	79.8	82.21	85.23	86.52		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	224.73	199.94	213.34	196.25	196.36	176.86	169.91	186.37	186.01	203.18	207.17	218.86		
Total = Sum(219a)$_{1...12}$ =													2378.98	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1492.38	
Water heating fuel used			2378.98	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			330.71	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	322.35	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	513.86	(264)
Space and water heating	(261) + (262) + (263) + (264) =				836.21	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	171.64	(268)

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Total CO2, kg/year	sum of (265)…(271) =	1046.78	(272)
TER =		13.92	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-3-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	76.86	(1a) x	2.4	(2a) =	184.46	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76.86	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.46	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			6.9	x1/[1/(1.2)+ 0.04]		=	7.9			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	31.77	14.26	17.51	x	0.18	=	3.15			(29)
Walls Type2	23.59	2.1	21.49	x	0.18	=	3.87			(29)
Total area of elements, m²			55.36							(31)
Party wall			33.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.87 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.48 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 35.35 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	65.78	65.78	65.78	65.78	65.78	65.78	65.78	65.78	65.78	65.78	65.78	65.78	

Average = Sum(39)$_{1…12}$ /12= 65.78 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86

Average = Sum(40)1…12 /12= 0.86 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.4 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.21 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.34	96.69	93.04	89.39	85.74	82.09	82.09	85.74	89.39	93.04	96.69	100.34	
										Total = Sum(44)1…12 =		1094.57	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	148.79	130.14	134.29	117.08	112.34	96.94	89.83	103.08	104.31	121.56	132.7	144.1	
										Total = Sum(45)1…12 =		1435.15	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	22.32	19.52	20.14	17.56	16.85	14.54	13.47	15.46	15.65	18.23	19.9	21.61	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

DER WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	204.07	180.06	189.57	170.57	167.61	150.43	145.1	158.36	157.8	176.84	186.19	199.38	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	204.07	180.06	189.57	170.57	167.61	150.43	145.1	158.36	157.8	176.84	186.19	199.38	

Output from water heater (annual)$_{1...12}$ 2085.99 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.7	83.21	88.87	81.72	81.57	75.03	74.09	78.5	77.48	84.64	86.92	92.13	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.01	16.88	13.73	10.39	7.77	6.56	7.09	9.21	12.37	15.7	18.33	19.54	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	212.75	214.96	209.4	197.55	182.6	168.55	159.16	156.96	162.52	174.36	189.31	203.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35	35	35	35	35	35	35	35	35	35	35	35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	(71)

Water heating gains (Table 5)

(72)m=	125.93	123.83	119.45	113.5	109.64	104.2	99.58	105.5	107.61	113.77	120.72	123.84	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	416.7	414.68	401.59	380.46	359.02	338.32	324.84	330.68	341.5	362.84	387.37	405.75	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	6.9	x	46.75	x	0.5	x	0.8	=	89.42	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	6.9	x	76.57	x	0.5	x	0.8	=	146.45	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)

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South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	6.9	x	97.53	x	0.5	x	0.8	=	186.55	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	6.9	x	110.23	x	0.5	x	0.8	=	210.84	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	6.9	x	114.87	x	0.5	x	0.8	=	219.71	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	6.9	x	110.55	x	0.5	x	0.8	=	211.44	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	6.9	x	108.01	x	0.5	x	0.8	=	206.59	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	6.9	x	104.89	x	0.5	x	0.8	=	200.63	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	6.9	x	101.89	x	0.5	x	0.8	=	194.87	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	6.9	x	82.59	x	0.5	x	0.8	=	157.96	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	6.9	x	55.42	x	0.5	x	0.8	=	106	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	6.9	x	40.4	x	0.5	x	0.8	=	77.27	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)

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West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	164.06	273.48	359.33	422.01	452.71	440.98	428.65	406.82	381.09	298.15	195.39	141.14	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	580.77	688.16	760.91	802.47	811.73	779.3	753.49	737.5	722.59	660.98	582.76	546.88	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.86	0.72	0.54	0.38	0.41	0.62	0.88	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.33	20.5	20.69	20.86	20.96	21	21	21	20.99	20.87	20.56	20.28	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.83	0.67	0.47	0.31	0.34	0.55	0.84	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.31	19.56	19.83	20.06	20.17	20.2	20.2	20.2	20.2	20.07	19.65	19.24	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.72	19.94	20.18	20.38	20.49	20.52	20.52	20.52	20.51	20.39	20.01	19.65	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.72	19.94	20.18	20.38	20.49	20.52	20.52	20.52	20.51	20.39	20.01	19.65	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.93	0.84	0.69	0.5	0.34	0.37	0.58	0.85	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	573.69	666.21	704.51	672.01	557.6	387.09	257.87	270.91	416.22	564.06	565.32	542.08	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1014.25	989.29	899.73	755.24	578.18	389.39	258.05	271.19	421.91	643.79	849.26	1016.64	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	327.78	217.11	145.24	59.93	15.31	0	0	0	0	59.32	204.44	353.07	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = | 1382.2 | (98)

Space heating requirement in kWh/m²/year | 17.98 | (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1382.2	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1451.31	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2085.99	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2190.29	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	36.42	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		49.74	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	49.74	(331)
Energy for lighting (calculated in Appendix L)		335.67	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	845.79	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	18.9	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	864.69	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				864.69	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	25.81	(378)

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CO2 associated with electricity for lighting	(332))) x	0.52	=	174.21	(379)
Total CO2, kg/year	sum of (376)…(382) =			1064.71	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			13.85	(384)
EI rating (section 14)				88.29	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b2-3-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	76.86	(1a) x	2.4	(2a) =	184.46	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76.86	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.46	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.32	0.35	0.38	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			6.9	x1/[1/(1.4)+ 0.04]		=	9.15			(27)
Windows Type 2			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	31.77	14.26	17.51	x	0.18	=	3.15			(29)
Walls Type2	23.59	2.1	21.49	x	0.18	=	3.87			(29)
Total area of elements, m²			55.36							(31)
Party wall			33.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	28.03	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		4.64	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	32.66	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	36.52	36.29	36.06	34.97	34.76	33.82	33.82	33.64	34.18	34.76	35.18	35.61	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	69.19	68.95	68.72	67.63	67.43	66.48	66.48	66.3	66.84	67.43	67.84	68.27	

Average = Sum(39)$_{1\ldots12}$ /12= 67.63 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.9	0.9	0.89	0.88	0.88	0.86	0.86	0.86	0.87	0.88	0.88	0.89	

Average = Sum(40)$_{1…12}$ /12= 0.88 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.4 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.21 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	100.34	96.69	93.04	89.39	85.74	82.09	82.09	85.74	89.39	93.04	96.69	100.34	

Total = Sum(44)$_{1…12}$ = 1094.57 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	148.79	130.14	134.29	117.08	112.34	96.94	89.83	103.08	104.31	121.56	132.7	144.1	

Total = Sum(45)$_{1…12}$ = 1435.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	22.32	19.52	20.14	17.56	16.85	14.54	13.47	15.46	15.65	18.23	19.9	21.61	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	195.39	172.22	180.88	162.17	158.93	142.03	136.42	149.67	149.4	168.16	177.79	190.69	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	195.39	172.22	180.88	162.17	158.93	142.03	136.42	149.67	149.4	168.16	177.79	190.69	

Output from water heater (annual) $_{1...12}$ 1983.77 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.75	76.94	81.93	75	74.63	68.31	67.14	71.55	70.76	77.7	80.19	85.19	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.28	17.13	13.93	10.54	7.88	6.65	7.19	9.35	12.54	15.93	18.59	19.82	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	212.75	214.96	209.4	197.55	182.6	168.55	159.16	156.96	162.52	174.36	189.31	203.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35	35	35	35	35	35	35	35	35	35	35	35	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	(71)

Water heating gains (Table 5)

(72)m=	116.6	114.49	110.12	104.17	100.31	94.87	90.25	96.17	98.27	104.43	111.38	114.5	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	410.64	408.59	395.45	374.28	352.8	332.08	318.61	324.48	335.35	356.73	381.3	399.69	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	6.9	x	46.75	x	0.63	x	0.7	=	98.59	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.63	x	0.7	=	26.29	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	6.9	x	76.57	x	0.63	x	0.7	=	161.46	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.63	x	0.7	=	43.06	(78)

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South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	6.9	x	97.53	x	0.63	x	0.7	=	205.67	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.63	x	0.7	=	54.85	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	6.9	x	110.23	x	0.63	x	0.7	=	232.45	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.63	x	0.7	=	61.99	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	6.9	x	114.87	x	0.63	x	0.7	=	242.23	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.63	x	0.7	=	64.6	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	6.9	x	110.55	x	0.63	x	0.7	=	233.12	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.63	x	0.7	=	62.16	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	6.9	x	108.01	x	0.63	x	0.7	=	227.77	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.63	x	0.7	=	60.74	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	6.9	x	104.89	x	0.63	x	0.7	=	221.19	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.63	x	0.7	=	58.99	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	6.9	x	101.89	x	0.63	x	0.7	=	214.85	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.63	x	0.7	=	57.29	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	6.9	x	82.59	x	0.63	x	0.7	=	174.15	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.63	x	0.7	=	46.44	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	6.9	x	55.42	x	0.63	x	0.7	=	116.86	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.63	x	0.7	=	31.16	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	6.9	x	40.4	x	0.63	x	0.7	=	85.19	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.63	x	0.7	=	22.72	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)

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West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	180.88	301.51	396.16	465.26	499.11	486.18	472.58	448.52	420.15	328.71	215.42	155.6	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	591.52	710.1	791.61	839.54	851.91	818.26	791.19	773	755.5	685.44	596.72	555.3	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.85	0.7	0.52	0.37	0.39	0.6	0.87	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.47	20.68	20.87	20.97	21	21	21	20.99	20.87	20.54	20.24	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.17	20.18	20.19	20.2	20.2	20.2	20.19	20.19	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.82	0.65	0.45	0.3	0.33	0.53	0.84	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.21	19.49	19.78	20.04	20.16	20.19	20.2	20.2	20.19	20.05	19.6	19.16	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.63	19.88	20.14	20.37	20.48	20.52	20.52	20.52	20.51	20.38	19.98	19.59	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.63	19.88	20.14	20.37	20.48	20.52	20.52	20.52	20.51	20.38	19.98	19.59	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.83	0.67	0.48	0.33	0.35	0.56	0.85	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	584.17	686.4	729.91	693.46	572.2	391.28	260.32	272.88	423.09	579.31	578.04	550.27	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1060.81	1032.73	937.19	775.78	591.98	393.24	260.47	273.11	428.3	659.16	873.55	1050.85	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	354.62	232.73	154.22	59.27	14.72	0	0	0	0	59.41	212.77	372.43	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 1460.17 (98)

Space heating requirement in kWh/m²/year 19 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	354.62	232.73	154.22	59.27	14.72	0	0	0	0	59.41	212.77	372.43		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	379.27	248.91	164.94	63.39	15.74	0	0	0	0	63.54	227.56	398.32		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1561.68	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	195.39	172.22	180.88	162.17	158.93	142.03	136.42	149.67	149.4	168.16	177.79	190.69		
Efficiency of water heater													79.8	(216)
(217)m=	86.39	85.62	84.39	82.41	80.61	79.8	79.8	79.8	79.8	82.34	85.29	86.57		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	226.18	201.15	214.34	196.79	197.17	177.98	170.96	187.56	187.22	204.22	208.44	220.28		
Total = Sum(219a)$_{1...12}$ =													2392.29	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1561.68	
Water heating fuel used			2392.29	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			340.54	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	337.32	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	516.74	(264)
Space and water heating	(261) + (262) + (263) + (264) =			854.06	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	176.74	(268)

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Total CO2, kg/year	sum of (265)…(271) =	1069.72	(272)
TER =		13.92	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-3-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.72	(1a) x	2.4	(2a) =	176.93	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.72	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.93	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Walls Type1	41.25	15.64	25.61	x	0.18	=	4.61			(29)
Walls Type2	4.81	2.1	2.71	x	0.18	=	0.49			(29)
Total area of elements, m²			46.06							(31)
Party wall			43.17	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.53 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.64 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 35.17 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.36	64.36	64.36	64.36	64.36	64.36	64.36	64.36	64.36	64.36	64.36	64.36

Average = Sum(39)$_{1…12}$ /12= 64.36 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87

Average = Sum(40)$_{1…12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.61 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	98.57	94.98	91.4	87.82	84.23	80.65	80.65	84.23	87.82	91.4	94.98	98.57

Total = Sum(44)$_{1…12}$ = 1075.29 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.17	127.84	131.92	115.01	110.36	95.23	88.25	101.26	102.47	119.42	130.36	141.56

Total = Sum(45)$_{1…12}$ = 1409.88 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.93	19.18	19.79	17.25	16.55	14.28	13.24	15.19	15.37	17.91	19.55	21.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.45	177.77	187.2	168.51	165.64	148.73	143.52	156.54	155.97	174.7	183.85	196.84	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.45	177.77	187.2	168.51	165.64	148.73	143.52	156.54	155.97	174.7	183.85	196.84

Output from water heater (annual)$_{1...12}$	2060.72	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.82	82.45	88.09	81.04	80.92	74.46	73.56	77.89	76.87	83.93	86.14	91.29	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.35	16.3	13.25	10.03	7.5	6.33	6.84	8.89	11.94	15.16	17.69	18.86	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.82	207.95	202.57	191.12	176.65	163.06	153.98	151.84	157.22	168.68	183.14	196.74	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	(71)

Water heating gains (Table 5)

(72)m=	124.76	122.69	118.4	112.55	108.76	103.42	98.88	104.69	106.76	112.81	119.64	122.7	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	406.93	404.94	392.22	371.7	350.9	330.8	317.69	323.42	333.91	354.64	378.47	396.29	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)

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South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)

West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	161.2	273.58	370.43	450.44	495.29	487.26	471.65	439.12	398.42	301.43	192.93	138.04	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	568.13	678.52	762.64	822.13	846.2	818.06	789.34	762.55	732.33	656.07	571.4	534.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.93	0.84	0.68	0.5	0.36	0.39	0.6	0.87	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.31	20.5	20.7	20.88	20.97	21	21	21	20.99	20.87	20.55	20.26	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.8	0.63	0.44	0.29	0.32	0.53	0.84	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.28	19.55	19.83	20.06	20.17	20.19	20.19	20.19	20.18	20.05	19.62	19.21	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.7	19.93	20.18	20.39	20.49	20.51	20.51	20.51	20.51	20.38	19.99	19.63	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.7	19.93	20.18	20.39	20.49	20.51	20.51	20.51	20.51	20.38	19.99	19.63	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.81	0.65	0.46	0.32	0.35	0.56	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	560.73	655.08	699.16	668.72	549.97	378.84	251.79	264.56	407.41	554.11	553.28	529.32	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	990.96	967.21	880.57	739.5	565.6	380.48	251.92	264.79	412.31	629.5	829.93	993.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	320.09	209.76	134.97	50.96	11.63	0	0	0	0	56.09	199.19	345.11

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1327.8 (98)

Space heating requirement in kWh/m²/year 18.01 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1327.8	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1394.19	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2060.72	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2163.75	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	35.58	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.7	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	47.7	(331)

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Energy for lighting (calculated in Appendix L)			324.05	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	= 826.36	(367)
Electrical energy for heat distribution	[(313) x		0.52	= 18.47	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			= 844.83	(373)
CO2 associated with space heating (secondary)	(309) x		0	= 0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	= 0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			844.83	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	= 24.76	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	= 168.18	(379)
Total CO2, kg/year	sum of (376)…(382) =			1037.77	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			14.08	(384)
EI rating (section 14)				88.29	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-3-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	73.72	(1a)	x	2.4	(2a)	=	176.93	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.72	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	176.93	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30 ÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.45	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 5			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Walls Type1	41.25	15.64	25.61	x	0.18	=	4.61			(29)
Walls Type2	4.81	2.1	2.71	x	0.18	=	0.49			(29)
Total area of elements, m²			46.06							(31)
Party wall			43.17	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 27.93 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.71 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 32.65 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	35.23	34.99	34.76	33.69	33.48	32.54	32.54	32.37	32.91	33.48	33.89	34.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	67.88	67.64	67.41	66.33	66.13	65.19	65.19	65.02	65.55	66.13	66.54	66.97	

Average = $Sum(39)_{1...12}$ /12= 66.33 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.92	0.92	0.91	0.9	0.9	0.88	0.88	0.88	0.89	0.9	0.9	0.91	

Average = $Sum(40)_{1...12}$ /12= 0.9 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.61 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	98.57	94.98	91.4	87.82	84.23	80.65	80.65	84.23	87.82	91.4	94.98	98.57	

Total = $Sum(44)_{1...12}$ = 1075.29 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.17	127.84	131.92	115.01	110.36	95.23	88.25	101.26	102.47	119.42	130.36	141.56	

Total = $Sum(45)_{1...12}$ = 1409.88 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.93	19.18	19.79	17.25	16.55	14.28	13.24	15.19	15.37	17.91	19.55	21.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	192.77	169.93	178.52	160.11	156.95	140.32	134.84	147.86	147.57	166.02	175.45	188.16	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	192.77	169.93	178.52	160.11	156.95	140.32	134.84	147.86	147.57	166.02	175.45	188.16	

Output from water heater (annual)$_{1…12}$	1958.49	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.88	76.18	81.14	74.32	73.97	67.74	66.62	70.95	70.15	76.98	79.42	84.35	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.39	16.33	13.28	10.05	7.52	6.35	6.86	8.91	11.96	15.19	17.73	18.9	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.82	207.95	202.57	191.12	176.65	163.06	153.98	151.84	157.22	168.68	183.14	196.74	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	(71)

Water heating gains (Table 5)

(72)m=	115.43	113.36	109.06	103.22	99.42	94.08	89.54	95.36	97.42	103.47	110.3	113.37	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	400.63	398.64	385.91	365.38	344.58	324.48	311.37	317.11	327.6	348.34	372.17	390	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)

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South	0.9x	0.77	x	4.6	x	46.75	x	0.63	x	0.7	=	65.72	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.63	x	0.7	=	107.64	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.63	x	0.7	=	137.12	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.63	x	0.7	=	154.97	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.63	x	0.7	=	161.49	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.63	x	0.7	=	155.41	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.63	x	0.7	=	151.85	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.63	x	0.7	=	147.46	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.63	x	0.7	=	143.23	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.63	x	0.7	=	116.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.63	x	0.7	=	77.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.63	x	0.7	=	56.79	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)

West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	177.73	301.62	408.39	496.61	546.06	537.21	520	484.13	439.26	332.33	212.71	152.19	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	578.36	700.26	794.3	861.99	890.64	861.68	831.36	801.24	766.86	680.67	584.88	542.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.93	0.83	0.67	0.48	0.34	0.37	0.58	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.26	20.46	20.68	20.88	20.97	21	21	21	20.99	20.87	20.53	20.22	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.16	20.17	20.17	20.18	20.18	20.18	20.18	20.17	20.17	20.16	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.79	0.61	0.42	0.28	0.31	0.52	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.17	19.46	19.77	20.04	20.15	20.18	20.18	20.18	20.17	20.03	19.57	19.12	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.86	20.14	20.38	20.48	20.51	20.51	20.51	20.5	20.37	19.96	19.56	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.86	20.14	20.38	20.48	20.51	20.51	20.51	20.5	20.37	19.96	19.56	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.8	0.63	0.45	0.31	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	570.72	675.1	725.16	690.85	565.23	383.62	254.68	267	414.88	569.6	565.6	536.97	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1038.73	1011.96	919.38	761.3	580.39	385.03	254.79	267.18	419.43	645.91	855.43	1028.74	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	348.2	226.37	144.5	50.73	11.28	0	0	0	0	56.77	208.68	365.88

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1412.4 (98)

Space heating requirement in kWh/m²/year 19.16 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	348.2	226.37	144.5	50.73	11.28	0	0	0	0	56.77	208.68	365.88	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	372.41	242.11	154.54	54.25	12.06	0	0	0	0	60.72	223.18	391.32	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1510.59 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

192.77	169.93	178.52	160.11	156.95	140.32	134.84	147.86	147.57	166.02	175.45	188.16

Efficiency of water heater 79.8 (216)

(217)m=	86.37	85.58	84.26	82.14	80.44	79.8	79.8	79.8	79.8	82.28	85.28	86.56	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	223.18	198.56	211.88	194.93	195.13	175.84	168.97	185.29	184.92	201.77	205.74	217.38

Total = Sum(219a)$_{1...12}$ = 2363.59 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1510.59
Water heating fuel used		2363.59
Electricity for pumps, fans and electric keep-hot		

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central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			324.72	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	326.29	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	510.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =			836.82	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	168.53	(268)
Total CO2, kg/year		sum of (265)…(271) =		1044.28	(272)

TER = 14.17 (273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-3-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	92.81	(1a) x	2.4	(2a) =	222.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		222.74	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

DRAFT

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 4			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	39.36	16.33	23.03	x	0.18	=	4.15			(29)
Walls Type2	23.43	2.1	21.33	x	0.18	=	3.84			(29)
Total area of elements, m²			62.79							(31)
Party wall			43.2	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 29.2 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.71 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 40.91 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	77.66	77.66	77.66	77.66	77.66	77.66	77.66	77.66	77.66	77.66	77.66	77.66	

Average = $Sum(39)_{1...12}$ /12= 77.66 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84

Average = $Sum(40)_{1...12}$ /12= 0.84 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.66 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	107.17	103.27	99.38	95.48	91.58	87.69	87.69	91.58	95.48	99.38	103.27	107.17

Total = $Sum(44)_{1...12}$ = 1169.14 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.93	139	143.44	125.05	119.99	103.54	95.95	110.1	111.42	129.85	141.74	153.92

Total = $Sum(45)_{1...12}$ = 1532.93 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.84	20.85	21.52	18.76	18	15.53	14.39	16.52	16.71	19.48	21.26	23.09	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	214.21	188.93	198.72	178.55	175.27	157.04	151.23	165.38	164.91	185.12	195.23	209.19	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	214.21	188.93	198.72	178.55	175.27	157.04	151.23	165.38	164.91	185.12	195.23	209.19

Output from water heater (annual)$_{1...12}$ | 2183.77 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	97.07	86.16	91.91	84.38	84.12	77.22	76.12	80.83	79.84	87.4	89.92	95.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.91	19.46	15.82	11.98	8.96	7.56	8.17	10.62	14.25	18.1	21.12	22.52	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	244.15	246.69	240.3	226.71	209.55	193.43	182.66	180.12	186.51	200.1	217.26	233.38	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	(71)

Water heating gains (Table 5)

(72)m=	130.47	128.22	123.54	117.19	113.06	107.25	102.32	108.64	110.89	117.47	124.89	128.22	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	459.46	457.29	442.6	418.81	394.51	371.18	356.08	362.32	374.58	398.6	426.2	447.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)

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North	0.9x	0.77	x	4.6	x	10.63	x	0.5	x	0.8	=	13.56	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.5	x	0.8	=	25.91	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	4.6	x	34.53	x	0.5	x	0.8	=	44.03	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.5	x	0.8	=	70.72	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.5	x	0.8	=	95.27	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.5	x	0.8	=	101.99	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.5	x	0.8	=	95.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.5	x	0.8	=	75.55	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.5	x	0.8	=	52.94	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.5	x	0.8	=	30.84	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.5	x	0.8	=	16.73	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.5	x	0.8	=	11.3	(74)
West	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(80)

West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.23	132.37	220.45	333.22	423.85	441.92	417.35	347.25	259.5	157.25	84.75	56.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	527.69	589.67	663.05	752.03	818.36	813.1	773.42	709.57	634.08	555.85	510.96	503.44	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.94	0.81	0.6	0.44	0.5	0.78	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.17	20.29	20.49	20.75	20.93	20.99	21	21	20.96	20.71	20.39	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.76	0.53	0.36	0.42	0.72	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.11	19.27	19.57	19.93	20.16	20.22	20.22	20.22	20.19	19.88	19.42	19.06	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.68	19.94	20.26	20.47	20.53	20.53	20.53	20.5	20.22	19.81	19.49	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.68	19.94	20.26	20.47	20.53	20.53	20.53	20.5	20.22	19.81	19.49	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.93	0.78	0.56	0.39	0.45	0.74	0.96	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	526.19	585.95	650.14	696.15	635.1	455.33	304.97	319.88	470.83	532.69	507.59	502.37	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1183.02	1147.81	1043.77	882.29	681.04	460.25	305.39	320.86	496.82	746.78	986.8	1187.41	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	488.68	377.57	292.86	134.02	34.18	0	0	0	0	159.28	345.03	509.67

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2341.29	(98)
Space heating requirement in kWh/m²/year	25.23	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2341.29	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2458.35	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2183.77	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2292.96	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	47.51	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		60.06	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	60.06	(331)

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Energy for lighting (calculated in Appendix L)				386.9	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	= 1103.53	(367)
Electrical energy for heat distribution	[(313) x		0.52	= 24.66	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			= 1128.19	(373)
CO2 associated with space heating (secondary)	(309) x		0	= 0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	= 0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1128.19	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	= 31.17	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	= 200.8	(379)
Total CO2, kg/year	sum of (376)…(382) =			1360.16	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			14.66	(384)
EI rating (section 14)				86.77	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b2-3-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	92.81	(1a) x	2.4	(2a) =	222.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.81	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	222.74	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.38	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.84		x1/[1/(1.4)+ 0.04]	=	2.44			(27)
Windows Type 2			1.84		x1/[1/(1.4)+ 0.04]	=	2.44			(27)
Windows Type 3			4.6		x1/[1/(1.4)+ 0.04]	=	6.1			(27)
Windows Type 4			5.29		x1/[1/(1.4)+ 0.04]	=	7.01			(27)
Windows Type 5			2.76		x1/[1/(1.4)+ 0.04]	=	3.66			(27)
Walls Type1	39.36	16.33	23.03	x	0.18	=	4.15			(29)
Walls Type2	23.43	2.1	21.33	x	0.18	=	3.84			(29)
Total area of elements, m²			62.79							(31)
Party wall			43.2	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.73 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.01 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 37.75 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	43.14	42.89	42.65	41.51	41.29	40.3	40.3	40.11	40.68	41.29	41.73	42.18	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	80.89	80.64	80.4	79.25	79.04	78.05	78.05	77.86	78.43	79.04	79.47	79.92	

Average = Sum(39)$_{1…12}$ /12= 79.25 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.87	0.87	0.87	0.85	0.85	0.84	0.84	0.84	0.85	0.85	0.86	0.86	

Average = Sum(40)$_{1…12}$ /12= 0.85 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.66 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	107.17	103.27	99.38	95.48	91.58	87.69	87.69	91.58	95.48	99.38	103.27	107.17	

Total = Sum(44)$_{1…12}$ = 1169.14 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.93	139	143.44	125.05	119.99	103.54	95.95	110.1	111.42	129.85	141.74	153.92	

Total = Sum(45)$_{1…12}$ = 1532.93 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.84	20.85	21.52	18.76	18	15.53	14.39	16.52	16.71	19.48	21.26	23.09	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

		(58)
Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.53	181.09	190.03	170.15	166.59	148.64	142.54	156.7	156.51	176.44	186.83	200.51	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.53	181.09	190.03	170.15	166.59	148.64	142.54	156.7	156.51	176.44	186.83	200.51

Output from water heater (annual)$_{1...12}$ | 2081.55 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.12	79.89	84.97	77.65	77.17	70.5	69.18	73.88	73.12	80.45	83.2	88.45	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.31	19.82	16.12	12.2	9.12	7.7	8.32	10.82	14.52	18.43	21.51	22.93	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	244.15	246.69	240.3	226.71	209.55	193.43	182.66	180.12	186.51	200.1	217.26	233.38	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	(71)

Water heating gains (Table 5)

(72)m=	121.13	118.88	114.21	107.85	103.73	97.92	92.98	99.31	101.56	108.13	115.56	118.89	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	453.53	451.32	436.56	412.7	388.34	364.98	349.89	356.18	368.51	392.6	420.26	441.14	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.84	x	10.63	x	0.63	x	0.7	=	5.98	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.63	x	0.7	=	5.98	(74)

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North	0.9x	0.77	x	4.6	x	10.63	x	0.63	x	0.7	=	14.95	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.63	x	0.7	=	11.43	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.63	x	0.7	=	11.43	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.63	x	0.7	=	28.57	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.63	x	0.7	=	19.42	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.63	x	0.7	=	19.42	(74)
North	0.9x	0.77	x	4.6	x	34.53	x	0.63	x	0.7	=	48.54	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.63	x	0.7	=	31.19	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.63	x	0.7	=	31.19	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.63	x	0.7	=	77.97	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.63	x	0.7	=	42.01	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.63	x	0.7	=	42.01	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.63	x	0.7	=	105.04	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.63	x	0.7	=	44.98	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.63	x	0.7	=	44.98	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.63	x	0.7	=	112.44	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.63	x	0.7	=	41.99	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.63	x	0.7	=	41.99	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.63	x	0.7	=	104.98	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.63	x	0.7	=	33.32	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.63	x	0.7	=	33.32	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.63	x	0.7	=	83.29	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.63	x	0.7	=	23.35	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.63	x	0.7	=	23.35	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.63	x	0.7	=	58.36	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.63	x	0.7	=	13.6	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.63	x	0.7	=	13.6	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.63	x	0.7	=	34.01	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.63	x	0.7	=	7.38	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.63	x	0.7	=	7.38	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.63	x	0.7	=	18.44	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.63	x	0.7	=	4.98	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.63	x	0.7	=	4.98	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.63	x	0.7	=	12.46	(74)
West	0.9x	0.77	x	5.29	x	19.64	x	0.63	x	0.7	=	31.75	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.63	x	0.7	=	62.11	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.63	x	0.7	=	102.29	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.63	x	0.7	=	149.19	(80)

West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.63	x	0.7	=	182.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.63	x	0.7	=	187.17	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.63	x	0.7	=	178.19	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.63	x	0.7	=	153.06	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.63	x	0.7	=	118.97	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.63	x	0.7	=	73.7	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.63	x	0.7	=	39.59	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.63	x	0.7	=	26.11	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	75.23	145.94	243.04	367.38	467.3	487.22	460.12	382.84	286.1	173.37	93.44	62.17	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	528.76	597.26	679.6	780.08	855.63	852.2	810.02	739.02	654.61	565.97	513.7	503.3	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.94	0.79	0.58	0.42	0.48	0.77	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.12	20.25	20.47	20.76	20.94	20.99	21	21	20.96	20.71	20.37	20.1	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.19	20.19	20.2	20.21	20.21	20.22	20.22	20.22	20.21	20.21	20.2	20.2	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.74	0.51	0.35	0.4	0.7	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.01	19.2	19.52	19.92	20.15	20.21	20.22	20.22	20.18	19.87	19.37	18.99	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.45	19.62	19.9	20.26	20.47	20.53	20.53	20.53	20.5	20.2	19.77	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.45	19.62	19.9	20.26	20.47	20.53	20.53	20.53	20.5	20.2	19.77	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.92	0.76	0.54	0.38	0.43	0.73	0.96	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	527.27	593.39	665.63	716.65	650.06	458.44	306.4	320.81	477.39	541.43	510.31	502.25	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1225.78	1186.78	1077.24	900.07	692.88	462.44	306.74	321.62	501.58	759.05	1006.98	1217.47	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	519.7	398.76	306.24	132.06	31.85	0	0	0	0	161.91	357.6	532.12

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2440.24 (98)

Space heating requirement in kWh/m²/year 26.29 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	519.7	398.76	306.24	132.06	31.85	0	0	0	0	161.91	357.6	532.12	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	555.82	426.48	327.52	141.24	34.07	0	0	0	0	173.16	382.46	569.12	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2609.88 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	205.53	181.09	190.03	170.15	166.59	148.64	142.54	156.7	156.51	176.44	186.83	200.51

Efficiency of water heater 79.8 (216)

(217)m=	87.19	86.86	86.08	84.15	81.34	79.8	79.8	79.8	79.8	84.59	86.52	87.3	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	235.73	208.48	220.76	202.2	204.79	186.26	178.63	196.36	196.13	208.59	215.94	229.69

Total = Sum(219a)$_{1...12}$ = 2483.57 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2609.88
Water heating fuel used		2483.57
Electricity for pumps, fans and electric keep-hot		

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central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			394.08	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	563.73	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	536.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1100.19	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	204.53	(268)
Total CO2, kg/year		sum of (265)…(271) =		1343.64	(272)

TER = 14.48 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-3-08

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.39	(1a) x	2.4	(2a) =	176.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			6.9	x1/[1/(1.2)+ 0.04]		=	7.9			(27)
Walls Type1	40.92	17.94	22.98	x	0.18	=	4.14			(29)
Walls Type2	21.61	2.1	19.51	x	0.18	=	3.51			(29)
Total area of elements, m²			62.53							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.71 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.08 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 41.79 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	70.85	70.85	70.85	70.85	70.85	70.85	70.85	70.85	70.85	70.85	70.85	70.85

Average = Sum(39)$_{1\ldots12}$ /12= 70.85 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97

Average = Sum(40)$_{1\ldots12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	98.37	94.8	91.22	87.64	84.07	80.49	80.49	84.07	87.64	91.22	94.8	98.37

Total = Sum(44)$_{1\ldots12}$ = 1073.18 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.89	127.59	131.67	114.79	110.14	95.04	88.07	101.06	102.27	119.19	130.1	141.28

Total = Sum(45)$_{1\ldots12}$ = 1407.11 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.88	19.14	19.75	17.22	16.52	14.26	13.21	15.16	15.34	17.88	19.52	21.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.16	177.52	186.94	168.28	165.42	148.54	143.35	156.34	155.77	174.46	183.6	196.56	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.16	177.52	186.94	168.28	165.42	148.54	143.35	156.34	155.77	174.46	183.6	196.56

Output from water heater (annual)1…12 | 2057.94 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.73	82.37	88	80.96	80.84	74.4	73.51	77.83	76.8	83.85	86.05	91.2	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.28	16.24	13.21	10	7.47	6.31	6.82	8.86	11.89	15.1	17.63	18.79	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.08	207.2	201.84	190.43	176.01	162.47	153.42	151.29	156.66	168.07	182.48	196.03	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	(71)

Water heating gains (Table 5)

(72)m=	124.64	122.57	118.28	112.45	108.66	103.33	98.8	104.6	106.67	112.7	119.52	122.58	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	405.88	403.9	391.21	370.75	350.03	329.99	316.92	322.64	333.1	353.76	377.51	395.28	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)

North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	6.9	x	19.64	x	0.5	x	0.8	=	37.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	6.9	x	38.42	x	0.5	x	0.8	=	73.49	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	6.9	x	63.27	x	0.5	x	0.8	=	121.02	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	6.9	x	92.28	x	0.5	x	0.8	=	176.5	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	6.9	x	113.09	x	0.5	x	0.8	=	216.31	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	6.9	x	115.77	x	0.5	x	0.8	=	221.43	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)

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West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	6.9	x	110.22	x	0.5	x	0.8	=	210.81	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	6.9	x	94.68	x	0.5	x	0.8	=	181.08	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	6.9	x	73.59	x	0.5	x	0.8	=	140.75	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	6.9	x	45.59	x	0.5	x	0.8	=	87.2	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	6.9	x	24.49	x	0.5	x	0.8	=	46.84	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	6.9	x	16.15	x	0.5	x	0.8	=	30.89	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	83.89	163.37	270.67	402.57	503.68	520.97	493.73	416.61	316.88	193.97	104.38	69.17	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	489.77	567.26	661.89	773.33	853.72	850.96	810.65	739.25	649.98	547.73	481.9	464.45	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.89	0.72	0.53	0.38	0.44	0.71	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.08	20.23	20.49	20.78	20.95	20.99	21	21	20.96	20.71	20.33	20.04	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.86	0.67	0.46	0.31	0.36	0.63	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.88	19.11	19.48	19.87	20.06	20.11	20.11	20.11	20.09	19.79	19.25	18.82	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.36	19.56	19.88	20.23	20.42	20.46	20.47	20.47	20.44	20.16	19.68	19.31	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.36	19.56	19.88	20.23	20.42	20.46	20.47	20.47	20.44	20.16	19.68	19.31	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.87	0.69	0.48	0.34	0.39	0.66	0.93	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	486.85	559.4	634.62	671.52	588.19	411.94	273.62	287.33	431.29	507.62	475.53	462.36	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1067.18	1038.59	948.09	802.87	617.61	415.3	273.96	288.08	448.99	677.13	891.32	1070.45	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	431.76	322.01	233.22	94.58	21.89	0	0	0	0	126.12	299.37	452.42

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1981.37 (98)

Space heating requirement in kWh/m²/year 27 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1981.37	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2080.44	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2057.94	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2160.84	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	42.41	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.49	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	47.49	(331)

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Energy for lighting (calculated in Appendix L)				322.88	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22 =	985.07	(367)
Electrical energy for heat distribution	[(313) x		0.52 =	22.01	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1007.08	(373)
CO2 associated with space heating (secondary)	(309) x		0 =	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22 =	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1007.08	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52 =	24.65	(378)
CO2 associated with electricity for lighting	(332))) x		0.52 =	167.57	(379)
Total CO2, kg/year	sum of (376)…(382) =			1199.3	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.34	(384)
EI rating (section 14)				86.43	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-3-08

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.39	(1a) x	2.4	(2a) =	176.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 2			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 3			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 4			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 5			6.25	x1/[1/(1.4)+ 0.04]		=	8.29			(27)
Walls Type1	40.92	16.25	24.67	x	0.18	=	4.44			(29)
Walls Type2	21.61	2.1	19.51	x	0.18	=	3.51			(29)
Total area of elements, m²			62.53							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.6 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.76 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 37.35 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	35.09	34.86	34.63	33.55	33.35	32.41	32.41	32.24	32.77	33.35	33.76	34.18		(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	72.44	72.21	71.98	70.9	70.7	69.76	69.76	69.59	70.12	70.7	71.11	71.54		
										Average = $\mathrm{Sum}(39)_{1...12}$ /12=			70.9	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.99	0.98	0.98	0.97	0.96	0.95	0.95	0.95	0.96	0.96	0.97	0.97		
										Average = $\mathrm{Sum}(40)_{1...12}$ /12=			0.97	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)														
(44)m=	98.37	94.8	91.22	87.64	84.07	80.49	80.49	84.07	87.64	91.22	94.8	98.37		
										Total = $\mathrm{Sum}(44)_{1...12}$ =			1073.18	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)														
(45)m=	145.89	127.59	131.67	114.79	110.14	95.04	88.07	101.06	102.27	119.19	130.1	141.28		
										Total = $\mathrm{Sum}(45)_{1...12}$ =			1407.11	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)														
(46)m=	21.88	19.14	19.75	17.22	16.52	14.26	13.21	15.16	15.34	17.88	19.52	21.19		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	192.48	169.68	178.26	159.88	156.74	140.14	134.67	147.66	147.36	165.78	175.19	187.88	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	192.48	169.68	178.26	159.88	156.74	140.14	134.67	147.66	147.36	165.78	175.19	187.88	

Output from water heater (annual)$_{1...12}$	1955.72	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.78	76.09	81.05	74.24	73.9	67.68	66.56	70.88	70.08	76.91	79.33	84.25	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.29	16.24	13.21	10	7.47	6.31	6.82	8.86	11.9	15.1	17.63	18.79	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.08	207.2	201.84	190.43	176.01	162.47	153.42	151.29	156.66	168.07	182.48	196.03	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	(71)

Water heating gains (Table 5)

(72)m=	115.3	113.23	108.94	103.11	99.33	93.99	89.46	95.27	97.33	103.37	110.18	113.24	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	399.55	397.56	384.88	364.42	343.7	323.66	310.59	316.31	326.77	347.43	371.18	388.95	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.5	x	10.63	x	0.63	x	0.7	=	8.12	(74)
North	0.9x	0.77	x	2.5	x	10.63	x	0.63	x	0.7	=	8.12	(74)

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North	0.9x	0.77	x	2.5	x	20.32	x	0.63	x	0.7	=	15.53	(74)
North	0.9x	0.77	x	2.5	x	20.32	x	0.63	x	0.7	=	15.53	(74)
North	0.9x	0.77	x	2.5	x	34.53	x	0.63	x	0.7	=	26.38	(74)
North	0.9x	0.77	x	2.5	x	34.53	x	0.63	x	0.7	=	26.38	(74)
North	0.9x	0.77	x	2.5	x	55.46	x	0.63	x	0.7	=	42.38	(74)
North	0.9x	0.77	x	2.5	x	55.46	x	0.63	x	0.7	=	42.38	(74)
North	0.9x	0.77	x	2.5	x	74.72	x	0.63	x	0.7	=	57.09	(74)
North	0.9x	0.77	x	2.5	x	74.72	x	0.63	x	0.7	=	57.09	(74)
North	0.9x	0.77	x	2.5	x	79.99	x	0.63	x	0.7	=	61.11	(74)
North	0.9x	0.77	x	2.5	x	79.99	x	0.63	x	0.7	=	61.11	(74)
North	0.9x	0.77	x	2.5	x	74.68	x	0.63	x	0.7	=	57.06	(74)
North	0.9x	0.77	x	2.5	x	74.68	x	0.63	x	0.7	=	57.06	(74)
North	0.9x	0.77	x	2.5	x	59.25	x	0.63	x	0.7	=	45.27	(74)
North	0.9x	0.77	x	2.5	x	59.25	x	0.63	x	0.7	=	45.27	(74)
North	0.9x	0.77	x	2.5	x	41.52	x	0.63	x	0.7	=	31.72	(74)
North	0.9x	0.77	x	2.5	x	41.52	x	0.63	x	0.7	=	31.72	(74)
North	0.9x	0.77	x	2.5	x	24.19	x	0.63	x	0.7	=	18.48	(74)
North	0.9x	0.77	x	2.5	x	24.19	x	0.63	x	0.7	=	18.48	(74)
North	0.9x	0.77	x	2.5	x	13.12	x	0.63	x	0.7	=	10.02	(74)
North	0.9x	0.77	x	2.5	x	13.12	x	0.63	x	0.7	=	10.02	(74)
North	0.9x	0.77	x	2.5	x	8.86	x	0.63	x	0.7	=	6.77	(74)
North	0.9x	0.77	x	2.5	x	8.86	x	0.63	x	0.7	=	6.77	(74)
West	0.9x	0.77	x	2.5	x	19.64	x	0.63	x	0.7	=	15.01	(80)
West	0.9x	0.77	x	2.5	x	19.64	x	0.63	x	0.7	=	15.01	(80)
West	0.9x	0.77	x	6.25	x	19.64	x	0.63	x	0.7	=	37.51	(80)
West	0.9x	0.77	x	2.5	x	38.42	x	0.63	x	0.7	=	29.35	(80)
West	0.9x	0.77	x	2.5	x	38.42	x	0.63	x	0.7	=	29.35	(80)
West	0.9x	0.77	x	6.25	x	38.42	x	0.63	x	0.7	=	73.39	(80)
West	0.9x	0.77	x	2.5	x	63.27	x	0.63	x	0.7	=	48.34	(80)
West	0.9x	0.77	x	2.5	x	63.27	x	0.63	x	0.7	=	48.34	(80)
West	0.9x	0.77	x	6.25	x	63.27	x	0.63	x	0.7	=	120.86	(80)
West	0.9x	0.77	x	2.5	x	92.28	x	0.63	x	0.7	=	70.5	(80)
West	0.9x	0.77	x	2.5	x	92.28	x	0.63	x	0.7	=	70.5	(80)
West	0.9x	0.77	x	6.25	x	92.28	x	0.63	x	0.7	=	176.26	(80)
West	0.9x	0.77	x	2.5	x	113.09	x	0.63	x	0.7	=	86.41	(80)
West	0.9x	0.77	x	2.5	x	113.09	x	0.63	x	0.7	=	86.41	(80)
West	0.9x	0.77	x	6.25	x	113.09	x	0.63	x	0.7	=	216.02	(80)
West	0.9x	0.77	x	2.5	x	115.77	x	0.63	x	0.7	=	88.45	(80)
West	0.9x	0.77	x	2.5	x	115.77	x	0.63	x	0.7	=	88.45	(80)
West	0.9x	0.77	x	6.25	x	115.77	x	0.63	x	0.7	=	221.13	(80)
West	0.9x	0.77	x	2.5	x	110.22	x	0.63	x	0.7	=	84.21	(80)

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West	0.9x	0.77	x	2.5	x	110.22	x	0.63	x	0.7	=	84.21	(80)
West	0.9x	0.77	x	6.25	x	110.22	x	0.63	x	0.7	=	210.53	(80)
West	0.9x	0.77	x	2.5	x	94.68	x	0.63	x	0.7	=	72.34	(80)
West	0.9x	0.77	x	2.5	x	94.68	x	0.63	x	0.7	=	72.34	(80)
West	0.9x	0.77	x	6.25	x	94.68	x	0.63	x	0.7	=	180.84	(80)
West	0.9x	0.77	x	2.5	x	73.59	x	0.63	x	0.7	=	56.22	(80)
West	0.9x	0.77	x	2.5	x	73.59	x	0.63	x	0.7	=	56.22	(80)
West	0.9x	0.77	x	6.25	x	73.59	x	0.63	x	0.7	=	140.56	(80)
West	0.9x	0.77	x	2.5	x	45.59	x	0.63	x	0.7	=	34.83	(80)
West	0.9x	0.77	x	2.5	x	45.59	x	0.63	x	0.7	=	34.83	(80)
West	0.9x	0.77	x	6.25	x	45.59	x	0.63	x	0.7	=	87.08	(80)
West	0.9x	0.77	x	2.5	x	24.49	x	0.63	x	0.7	=	18.71	(80)
West	0.9x	0.77	x	2.5	x	24.49	x	0.63	x	0.7	=	18.71	(80)
West	0.9x	0.77	x	6.25	x	24.49	x	0.63	x	0.7	=	46.78	(80)
West	0.9x	0.77	x	2.5	x	16.15	x	0.63	x	0.7	=	12.34	(80)
West	0.9x	0.77	x	2.5	x	16.15	x	0.63	x	0.7	=	12.34	(80)
West	0.9x	0.77	x	6.25	x	16.15	x	0.63	x	0.7	=	30.85	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	83.77	163.15	270.31	402.03	503	520.26	493.06	416.04	316.45	193.71	104.24	69.08	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	483.32	560.71	655.18	766.45	846.7	843.92	803.64	732.35	643.22	541.13	475.42	458.02	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.73	0.52	0.38	0.44	0.71	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.2	20.46	20.77	20.95	20.99	21	21	20.96	20.71	20.32	20.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.09	20.1	20.1	20.11	20.11	20.12	20.12	20.13	20.12	20.11	20.11	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.87	0.67	0.45	0.31	0.35	0.64	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.81	19.05	19.43	19.86	20.07	20.12	20.12	20.13	20.1	19.78	19.23	18.79	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.3	19.51	19.84	20.23	20.42	20.47	20.47	20.47	20.44	20.15	19.66	19.28	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.3	19.51	19.84	20.23	20.42	20.47	20.47	20.47	20.44	20.15	19.66	19.28	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.87	0.69	0.48	0.34	0.39	0.66	0.93	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	480.64	553.47	629.89	668.25	586.34	406.44	269.98	282.91	427.53	502.98	469.53	456.1	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1086.97	1054.9	960.4	803.01	616.33	409.48	270.28	283.57	444.8	675.39	893.38	1078.59	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	451.11	336.96	245.9	97.03	22.31	0	0	0	0	128.27	305.17	463.13

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2049.88 (98)

Space heating requirement in kWh/m²/year 27.93 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	451.11	336.96	245.9	97.03	22.31	0	0	0	0	128.27	305.17	463.13	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	482.47	360.39	262.99	103.77	23.86	0	0	0	0	137.19	326.39	495.32	(211)

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2192.38 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

192.48	169.68	178.26	159.88	156.74	140.14	134.67	147.66	147.36	165.78	175.19	187.88

Efficiency of water heater 79.8 (216)

(217)m=	87.01	86.61	85.67	83.53	80.99	79.8	79.8	79.8	79.8	84.14	86.28	87.13	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	221.22	195.91	208.07	191.41	193.52	175.61	168.76	185.04	184.67	197.03	203.05	215.63

Total = Sum(219a)$_{1...12}$ = 2339.91 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2192.38
Water heating fuel used		2339.91

Electricity for pumps, fans and electric keep-hot

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central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			322.93	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	473.55	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	505.42	(264)
Space and water heating	(261) + (262) + (263) + (264) =			978.98	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	167.6	(268)
Total CO2, kg/year		sum of (265)…(271) =		1185.5	(272)

TER = 16.15 (273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-9-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	76.86	(1a) x	2.4	(2a) =	184.46	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76.86	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.46	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			6.9	x1/[1/(1.2)+ 0.04]		=	7.9			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	31.77	14.26	17.51	x	0.18	=	3.15			(29)
Walls Type2	23.59	2.1	21.49	x	0.18	=	3.87			(29)
Roof	6.11	0	6.11	x	0.11	=	0.67			(30)
Total area of elements, m²			61.47							(31)
Party wall			33.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 26.54 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.23 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 38.77 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(38)m=	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	69.21	69.21	69.21	69.21	69.21	69.21	69.21	69.21	69.21	69.21	69.21	69.21	

Average = Sum(39)$_{1...12}$ /12= 69.21 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9

Average = Sum(40)$_{1...12}$ /12= 0.9 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.4 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.21 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	100.34	96.69	93.04	89.39	85.74	82.09	82.09	85.74	89.39	93.04	96.69	100.34

Total = Sum(44)$_{1...12}$ = 1094.57 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	148.79	130.14	134.29	117.08	112.34	96.94	89.83	103.08	104.31	121.56	132.7	144.1

Total = Sum(45)$_{1...12}$ = 1435.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.32	19.52	20.14	17.56	16.85	14.54	13.47	15.46	15.65	18.23	19.9	21.61	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	204.07	180.06	189.57	170.57	167.61	150.43	145.1	158.36	157.8	176.84	186.19	199.38	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	204.07	180.06	189.57	170.57	167.61	150.43	145.1	158.36	157.8	176.84	186.19	199.38

Output from water heater (annual)$_{1...12}$ | 2085.99 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.7	83.21	88.87	81.72	81.57	75.03	74.09	78.5	77.48	84.64	86.92	92.13	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	19.01	16.88	13.73	10.39	7.77	6.56	7.09	9.21	12.37	15.7	18.33	19.54	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	212.75	214.96	209.4	197.55	182.6	168.55	159.16	156.96	162.52	174.36	189.31	203.37	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	35	35	35	35	35	35	35	35	35	35	35	35	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	(71)
Water heating gains (Table 5)													
(72)m=	125.93	123.83	119.45	113.5	109.64	104.2	99.58	105.5	107.61	113.77	120.72	123.84	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	416.7	414.68	401.59	380.46	359.02	338.32	324.84	330.68	341.5	362.84	387.37	405.75	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	6.9	x	46.75	x	0.5	x	0.8	=	89.42	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)

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South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	6.9	x	76.57	x	0.5	x	0.8	=	146.45	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	6.9	x	97.53	x	0.5	x	0.8	=	186.55	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	6.9	x	110.23	x	0.5	x	0.8	=	210.84	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	6.9	x	114.87	x	0.5	x	0.8	=	219.71	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	6.9	x	110.55	x	0.5	x	0.8	=	211.44	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	6.9	x	108.01	x	0.5	x	0.8	=	206.59	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	6.9	x	104.89	x	0.5	x	0.8	=	200.63	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	6.9	x	101.89	x	0.5	x	0.8	=	194.87	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	6.9	x	82.59	x	0.5	x	0.8	=	157.96	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	6.9	x	55.42	x	0.5	x	0.8	=	106	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	6.9	x	40.4	x	0.5	x	0.8	=	77.27	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)

West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	164.06	273.48	359.33	422.01	452.71	440.98	428.65	406.82	381.09	298.15	195.39	141.14	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	580.77	688.16	760.91	802.47	811.73	779.3	753.49	737.5	722.59	660.98	582.76	546.88	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.88	0.74	0.56	0.4	0.43	0.64	0.89	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.26	20.44	20.64	20.83	20.95	20.99	21	21	20.98	20.83	20.5	20.21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.85	0.69	0.49	0.33	0.35	0.57	0.86	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.19	19.44	19.73	19.98	20.12	20.16	20.17	20.17	20.16	19.99	19.54	19.11	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.84	20.09	20.32	20.45	20.49	20.5	20.5	20.49	20.33	19.92	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.84	20.09	20.32	20.45	20.49	20.5	20.5	20.49	20.33	19.92	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.93	0.85	0.71	0.52	0.36	0.38	0.6	0.87	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	574.15	668.18	710.24	684.77	576.67	404.23	269.56	283.21	433.32	573.6	566.85	542.35	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1059.91	1033.93	940.66	790.31	605.72	407.91	269.88	283.7	441.96	673.33	887.38	1062.4	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	361.41	245.79	171.43	75.99	21.62	0	0	0	0	74.19	230.78	386.92	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1568.12 (98)

Space heating requirement in kWh/m²/year 20.4 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.			
Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1568.12	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1646.52	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2085.99	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2190.29	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	38.37	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		49.74	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	49.74	(331)
Energy for lighting (calculated in Appendix L)		335.67	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	891.13	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	19.91	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	911.04	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				911.04	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	25.81	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	174.21	(379)
Total CO2, kg/year	sum of (376)…(382) =			1111.07	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			14.46	(384)
EI rating (section 14)				87.78	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-9-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	76.86	(1a) x	2.4	(2a) =	184.46	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76.86	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.46	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.32	0.35	0.38	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			6.9	x1/[1/(1.4)+ 0.04]		=	9.15			(27)
Windows Type 2			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	31.77	14.26	17.51	x	0.18	=	3.15			(29)
Walls Type2	23.59	2.1	21.49	x	0.18	=	3.87			(29)
Roof	6.11	0	6.11	x	0.13	=	0.79			(30)
Total area of elements, m²			61.47							(31)
Party wall			33.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	28.82	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.07 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 35.89 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	36.52	36.29	36.06	34.97	34.76	33.82	33.82	33.64	34.18	34.76	35.18	35.61	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	72.42	72.18	71.95	70.86	70.66	69.71	69.71	69.53	70.07	70.66	71.07	71.5	

Average = Sum(39)$_{1…12}$ /12= 70.86 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.94	0.94	0.94	0.92	0.92	0.91	0.91	0.9	0.91	0.92	0.92	0.93

Average = Sum(40)$_{1…12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.4 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.21 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.34	96.69	93.04	89.39	85.74	82.09	82.09	85.74	89.39	93.04	96.69	100.34	

Total = Sum(44)$_{1…12}$ = 1094.57 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	148.79	130.14	134.29	117.08	112.34	96.94	89.83	103.08	104.31	121.56	132.7	144.1

Total = Sum(45)$_{1…12}$ = 1435.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.32	19.52	20.14	17.56	16.85	14.54	13.47	15.46	15.65	18.23	19.9	21.61	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	195.39	172.22	180.88	162.17	158.93	142.03	136.42	149.67	149.4	168.16	177.79	190.69	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	195.39	172.22	180.88	162.17	158.93	142.03	136.42	149.67	149.4	168.16	177.79	190.69

Output from water heater (annual)$_{1...12}$ | 1983.77 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.75	76.94	81.93	75	74.63	68.31	67.14	71.55	70.76	77.7	80.19	85.19	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.28	17.13	13.93	10.54	7.88	6.65	7.19	9.35	12.54	15.93	18.59	19.82	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	212.75	214.96	209.4	197.55	182.6	168.55	159.16	156.96	162.52	174.36	189.31	203.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35	35	35	35	35	35	35	35	35	35	35	35	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	(71)

Water heating gains (Table 5)

(72)m=	116.6	114.49	110.12	104.17	100.31	94.87	90.25	96.17	98.27	104.43	111.38	114.5	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	410.64	408.59	395.45	374.28	352.8	332.08	318.61	324.48	335.35	356.73	381.3	399.69	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	6.9	x	46.75	x	0.63	x	0.7	=	98.59	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.63	x	0.7	=	26.29	(78)

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South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	6.9	x	76.57	x	0.63	x	0.7	=	161.46	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.63	x	0.7	=	43.06	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	6.9	x	97.53	x	0.63	x	0.7	=	205.67	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.63	x	0.7	=	54.85	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	6.9	x	110.23	x	0.63	x	0.7	=	232.45	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.63	x	0.7	=	61.99	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	6.9	x	114.87	x	0.63	x	0.7	=	242.23	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.63	x	0.7	=	64.6	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	6.9	x	110.55	x	0.63	x	0.7	=	233.12	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.63	x	0.7	=	62.16	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	6.9	x	108.01	x	0.63	x	0.7	=	227.77	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.63	x	0.7	=	60.74	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	6.9	x	104.89	x	0.63	x	0.7	=	221.19	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.63	x	0.7	=	58.99	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	6.9	x	101.89	x	0.63	x	0.7	=	214.85	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.63	x	0.7	=	57.29	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	6.9	x	82.59	x	0.63	x	0.7	=	174.15	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.63	x	0.7	=	46.44	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	6.9	x	55.42	x	0.63	x	0.7	=	116.86	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.63	x	0.7	=	31.16	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	6.9	x	40.4	x	0.63	x	0.7	=	85.19	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.63	x	0.7	=	22.72	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)

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West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	180.88	301.51	396.16	465.26	499.11	486.18	472.58	448.52	420.15	328.71	215.42	155.6	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	591.52	710.1	791.61	839.54	851.91	818.26	791.19	773	755.5	685.44	596.72	555.3	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.87	0.73	0.54	0.39	0.41	0.62	0.89	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.41	20.62	20.83	20.95	20.99	21	21	20.98	20.84	20.49	20.17	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.13	20.13	20.14	20.15	20.15	20.16	20.16	20.16	20.16	20.15	20.15	20.14	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.83	0.67	0.47	0.31	0.34	0.55	0.85	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.09	19.37	19.68	19.97	20.11	20.16	20.16	20.16	20.15	19.98	19.5	19.04	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.54	19.79	20.06	20.31	20.45	20.49	20.5	20.5	20.48	20.32	19.89	19.5	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.54	19.79	20.06	20.31	20.45	20.49	20.5	20.5	20.48	20.32	19.89	19.5	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.93	0.84	0.69	0.5	0.34	0.37	0.58	0.86	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	584.56	688.2	735.32	706.17	590.68	407.66	271.36	284.51	439.49	588.69	579.48	550.5	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1103.43	1074.48	975.54	808.86	617.97	410.72	271.62	284.91	447.21	687	909.32	1093.7	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	386.04	259.58	178.72	73.94	20.3	0	0	0	0	73.15	237.48	404.14	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1633.35 | (98)

Space heating requirement in kWh/m²/year | 21.25 | (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	386.04	259.58	178.72	73.94	20.3	0	0	0	0	73.15	237.48	404.14		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	412.88	277.63	191.15	79.08	21.72	0	0	0	0	78.23	253.99	432.23		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1746.9	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	195.39	172.22	180.88	162.17	158.93	142.03	136.42	149.67	149.4	168.16	177.79	190.69		
Efficiency of water heater													79.8	(216)
(217)m=	86.6	85.91	84.78	82.87	80.88	79.8	79.8	79.8	79.8	82.77	85.59	86.77		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	225.63	200.48	213.35	195.69	196.5	177.98	170.96	187.56	187.22	203.17	207.73	219.77		
Total = Sum(219a)$_{1...12}$ =													2386.04	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1746.9	
Water heating fuel used			2386.04	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			340.54	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	377.33	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	515.38	(264)
Space and water heating	(261) + (262) + (263) + (264) =				892.72	(265)

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Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	176.74	(268)
Total CO2, kg/year			sum of (265)…(271) =		1108.38	(272)

TER = 14.42 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-9-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.72	(1a) x	2.4	(2a) =	176.93	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.72	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.93	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	41.25	15.64	25.61	x	0.18	=	4.61			(29)
Walls Type2	4.81	2.1	2.71	x	0.18	=	0.49			(29)
Roof	70.23	0	70.23	x	0.11	=	7.73			(30)
Total area of elements, m²			116.29							(31)
Party wall			43.17	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 16.32 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 49.57 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.77	78.77	78.77	78.77	78.77	78.77	78.77	78.77	78.77	78.77	78.77	78.77	

Average = Sum(39)$_{1…12}$ /12= 78.77 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	

Average = Sum(40)$_{1…12}$ /12= 1.07 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.61 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.57	94.98	91.4	87.82	84.23	80.65	80.65	84.23	87.82	91.4	94.98	98.57	

Total = Sum(44)$_{1…12}$ = 1075.29 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.17	127.84	131.92	115.01	110.36	95.23	88.25	101.26	102.47	119.42	130.36	141.56	

Total = Sum(45)$_{1…12}$ = 1409.88 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.93	19.18	19.79	17.25	16.55	14.28	13.24	15.19	15.37	17.91	19.55	21.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.45	177.77	187.2	168.51	165.64	148.73	143.52	156.54	155.97	174.7	183.85	196.84	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.45	177.77	187.2	168.51	165.64	148.73	143.52	156.54	155.97	174.7	183.85	196.84

Output from water heater (annual)$_{1...12}$ — 2060.72 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.82	82.45	88.09	81.04	80.92	74.46	73.56	77.89	76.87	83.93	86.14	91.29	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.35	16.3	13.25	10.03	7.5	6.33	6.84	8.89	11.94	15.16	17.69	18.86	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.82	207.95	202.57	191.12	176.65	163.06	153.98	151.84	157.22	168.68	183.14	196.74	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	(71)

Water heating gains (Table 5)

(72)m=	124.76	122.69	118.4	112.55	108.76	103.42	98.88	104.69	106.76	112.81	119.64	122.7	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	406.93	404.94	392.22	371.7	350.9	330.8	317.69	323.42	333.91	354.64	378.47	396.29	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)

West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	161.2	273.58	370.43	450.44	495.29	487.26	471.65	439.12	398.42	301.43	192.93	138.04	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	568.13	678.52	762.64	822.13	846.2	818.06	789.34	762.55	732.33	656.07	571.4	534.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.78	0.6	0.44	0.47	0.7	0.92	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.03	20.22	20.47	20.72	20.9	20.98	21	21	20.96	20.72	20.31	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.87	0.72	0.51	0.34	0.37	0.62	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.75	19.03	19.37	19.72	19.94	20.01	20.03	20.02	20	19.73	19.16	18.67	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.26	19.51	19.81	20.12	20.32	20.4	20.41	20.41	20.38	20.12	19.62	19.19	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.26	19.51	19.81	20.12	20.32	20.4	20.41	20.41	20.38	20.12	19.62	19.19	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.87	0.74	0.55	0.38	0.41	0.65	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	562.06	661.25	718.73	715.97	623.97	447.65	299.35	314.4	473.06	585.68	557.88	530.05	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1178.36	1150.42	1048.56	883.72	679.2	456.91	300.43	316.1	494.67	750.14	986.14	1180.99	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	458.53	328.72	245.4	120.78	41.09	0	0	0	0	122.36	308.35	484.31	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2109.54	(98)
Space heating requirement in kWh/m²/year	28.62	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2109.54	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2215.02	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2060.72	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2163.75	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.79	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.7	(330a)

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warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			47.7	(331)
Energy for lighting (calculated in Appendix L)				324.05	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1017	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	22.73	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1039.73	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1039.73	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	24.76	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	168.18	(379)
Total CO2, kg/year	sum of (376)…(382) =				1232.67	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				16.72	(384)
EI rating (section 14)					86.09	(385)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version: Version: 1.0.4.8

Property Address: b2-9-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.72	(1a) x	2.4	(2a) =	176.93	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.72	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.93	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.45	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 5			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	41.25	15.64	25.61	x	0.18	=	4.61			(29)
Walls Type2	4.81	2.1	2.71	x	0.18	=	0.49			(29)
Roof	70.23	0	70.23	x	0.13	=	9.13			(30)
Total area of elements, m²			116.29							(31)
Party wall			43.17	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.06 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 16.26 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 53.32 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.23	34.99	34.76	33.69	33.48	32.54	32.54	32.37	32.91	33.48	33.89	34.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.55	88.32	88.09	87.01	86.81	85.87	85.87	85.69	86.23	86.81	87.21	87.64	

Average = $Sum(39)_{1...12}$ /12= 87.01 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.2	1.2	1.19	1.18	1.18	1.16	1.16	1.16	1.17	1.18	1.18	1.19	

Average = $Sum(40)_{1...12}$ /12= 1.18 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.61 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	98.57	94.98	91.4	87.82	84.23	80.65	80.65	84.23	87.82	91.4	94.98	98.57	

Total = $Sum(44)_{1...12}$ = 1075.29 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.17	127.84	131.92	115.01	110.36	95.23	88.25	101.26	102.47	119.42	130.36	141.56	

Total = $Sum(45)_{1...12}$ = 1409.88 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.93	19.18	19.79	17.25	16.55	14.28	13.24	15.19	15.37	17.91	19.55	21.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	192.77	169.93	178.52	160.11	156.95	140.32	134.84	147.86	147.57	166.02	175.45	188.16	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	192.77	169.93	178.52	160.11	156.95	140.32	134.84	147.86	147.57	166.02	175.45	188.16

Output from water heater (annual)$_{1...12}$ | 1958.49 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.88	76.18	81.14	74.32	73.97	67.74	66.62	70.95	70.15	76.98	79.42	84.35	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.39	16.33	13.28	10.05	7.52	6.35	6.86	8.91	11.96	15.19	17.73	18.9	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.82	207.95	202.57	191.12	176.65	163.06	153.98	151.84	157.22	168.68	183.14	196.74	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	(71)

Water heating gains (Table 5)

(72)m=	115.43	113.36	109.06	103.22	99.42	94.08	89.54	95.36	97.42	103.47	110.3	113.37	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	400.63	398.64	385.91	365.38	344.58	324.48	311.37	317.11	327.6	348.34	372.17	390	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.63	x	0.7	=	65.72	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.63	x	0.7	=	107.64	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.63	x	0.7	=	137.12	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.63	x	0.7	=	154.97	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.63	x	0.7	=	161.49	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.63	x	0.7	=	155.41	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.63	x	0.7	=	151.85	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.63	x	0.7	=	147.46	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.63	x	0.7	=	143.23	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.63	x	0.7	=	116.1	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.63	x	0.7	=	77.91	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.63	x	0.7	=	56.79	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)

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West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	177.73	301.62	408.39	496.61	546.06	537.21	520	484.13	439.26	332.33	212.71	152.19	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	578.36	700.26	794.3	861.99	890.64	861.68	831.36	801.24	766.86	680.67	584.88	542.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.79	0.61	0.45	0.48	0.71	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.86	20.07	20.35	20.65	20.87	20.97	20.99	20.99	20.94	20.65	20.19	19.82	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.92	19.92	19.92	19.94	19.94	19.95	19.95	19.95	19.94	19.94	19.93	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.87	0.73	0.52	0.34	0.38	0.63	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.42	18.73	19.13	19.55	19.82	19.93	19.95	19.95	19.9	19.56	18.92	18.37	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19	19.27	19.62	19.99	20.24	20.35	20.37	20.37	20.32	20	19.43	18.95	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19	19.27	19.62	19.99	20.24	20.35	20.37	20.37	20.32	20	19.43	18.95	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.87	0.75	0.56	0.39	0.42	0.66	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	572.03	682.32	749.39	753.71	665.34	479.79	321.55	337.07	504.99	610.61	571.12	537.68	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1301.43	1269.17	1155.47	964.98	741.01	493.45	323.36	339.81	535.98	815.98	1075.38	1292.88	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	542.67	394.37	302.12	152.11	56.3	0	0	0	0	152.79	363.07	561.87	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2525.31 (98)

Space heating requirement in kWh/m²/year 34.26 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	542.67	394.37	302.12	152.11	56.3	0	0	0	0	152.79	363.07	561.87	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	580.4	421.78	323.13	162.68	60.22	0	0	0	0	163.41	388.31	600.93	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2700.86 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	192.77	169.93	178.52	160.11	156.95	140.32	134.84	147.86	147.57	166.02	175.45	188.16	
Efficiency of water heater												79.8	(216)
(217)m=	87.43	86.99	86.21	84.68	82.37	79.8	79.8	79.8	79.8	84.59	86.71	87.55	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	220.49	195.35	207.08	189.08	190.55	175.84	168.97	185.29	184.92	196.25	202.34	214.9	

Total = Sum(219a)$_{1...12}$ = 2331.06 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2700.86

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Water heating fuel used			2331.06	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			324.72	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	583.39	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	503.51	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1086.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	168.53	(268)
Total CO2, kg/year		sum of (265)…(271) =		1294.35	(272)

TER = 17.56 (273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-9-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	92.81	(1a) x	2.4	(2a) =	222.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.81	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	222.74	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 4			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 5			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Walls Type1	39.36	16.33	23.03	x	0.18	=	4.15			(29)
Walls Type2	23.43	2.1	21.33	x	0.18	=	3.84			(29)
Roof	51.52	0	51.52	x	0.11	=	5.67			(30)
Total area of elements, m²			114.31							(31)
Party wall			43.2	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	34.87	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		16.47	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	51.34	(37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.1	88.1	88.1	88.1	88.1	88.1	88.1	88.1	88.1	88.1	88.1	88.1	

Average = Sum(39)$_{1...12}$ /12= 88.1 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.66 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	107.17	103.27	99.38	95.48	91.58	87.69	87.69	91.58	95.48	99.38	103.27	107.17	

Total = Sum(44)$_{1...12}$ = 1169.14 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.93	139	143.44	125.05	119.99	103.54	95.95	110.1	111.42	129.85	141.74	153.92	

Total = Sum(45)$_{1...12}$ = 1532.93 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.84	20.85	21.52	18.76	18	15.53	14.39	16.52	16.71	19.48	21.26	23.09	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	214.21	188.93	198.72	178.55	175.27	157.04	151.23	165.38	164.91	185.12	195.23	209.19	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	214.21	188.93	198.72	178.55	175.27	157.04	151.23	165.38	164.91	185.12	195.23	209.19

Output from water heater (annual)1…12 | 2183.77 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	97.07	86.16	91.91	84.38	84.12	77.22	76.12	80.83	79.84	87.4	89.92	95.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.91	19.46	15.82	11.98	8.96	7.56	8.17	10.62	14.25	18.1	21.12	22.52	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	244.15	246.69	240.3	226.71	209.55	193.43	182.66	180.12	186.51	200.1	217.26	233.38	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	(71)

Water heating gains (Table 5)

(72)m=	130.47	128.22	123.54	117.19	113.06	107.25	102.32	108.64	110.89	117.47	124.89	128.22	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	459.46	457.29	442.6	418.81	394.51	371.18	356.08	362.32	374.58	398.6	426.2	447.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	4.6	x	10.63	x	0.5	x	0.8	=	13.56	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.5	x	0.8	=	25.91	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	4.6	x	34.53	x	0.5	x	0.8	=	44.03	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.5	x	0.8	=	70.72	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.5	x	0.8	=	95.27	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.5	x	0.8	=	101.99	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.5	x	0.8	=	95.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.5	x	0.8	=	75.55	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.5	x	0.8	=	52.94	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.5	x	0.8	=	30.84	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.5	x	0.8	=	16.73	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.5	x	0.8	=	11.3	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)

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West	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.23	132.37	220.45	333.22	423.85	441.92	417.35	347.25	259.5	157.25	84.75	56.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	527.69	589.67	663.05	752.03	818.36	813.1	773.42	709.57	634.08	555.85	510.96	503.44	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.86	0.67	0.5	0.56	0.84	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.01	20.13	20.35	20.64	20.87	20.98	21	20.99	20.92	20.61	20.25	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.94	0.81	0.59	0.4	0.46	0.77	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.79	18.97	19.29	19.7	20	20.11	20.12	20.12	20.06	19.66	19.14	18.74	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.28	19.43	19.71	20.07	20.35	20.46	20.47	20.47	20.4	20.04	19.59	19.23	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.28	19.43	19.71	20.07	20.35	20.46	20.47	20.47	20.4	20.04	19.59	19.23	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.82	0.62	0.44	0.5	0.79	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	526.24	586.31	652.37	708.75	673.14	502.38	339.66	355.39	502.42	537.44	507.92	502.38	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1319.5	1280.06	1163.76	984.26	762.2	516	341.22	358.64	555.27	831.74	1099.9	1324.43	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	590.19	466.2	380.47	198.37	66.26	0	0	0	0	218.96	426.22	611.61	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2958.28	(98)
Space heating requirement in kWh/m²/year	31.87	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2958.28	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	3106.2	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2183.77	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2292.96	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	53.99	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		60.06	(330a)

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warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			60.06	(331)
Energy for lighting (calculated in Appendix L)				386.9	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1254	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	28.02	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1282.02	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1282.02	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	31.17	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	200.8	(379)
Total CO2, kg/year	sum of (376)…(382) =				1513.99	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				16.31	(384)
EI rating (section 14)					85.28	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-9-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	92.81	(1a) x	2.4	(2a) =	222.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.81	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	222.74	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.38	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 4			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 5			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Walls Type1	39.36	16.33	23.03	x	0.18	=	4.15			(29)
Walls Type2	23.43	2.1	21.33	x	0.18	=	3.84			(29)
Roof	51.52	0	51.52	x	0.13	=	6.7			(30)
Total area of elements, m²			114.31							(31)
Party wall			43.2	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.43 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 16.06 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 54.49 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	43.14	42.89	42.65	41.51	41.29	40.3	40.3	40.11	40.68	41.29	41.73	42.18	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	97.63	97.39	97.14	96	95.79	94.79	94.79	94.61	95.18	95.79	96.22	96.67	

Average = Sum(39)$_{1...12}$ /12= 96 (39)

Heat loss parameter (HLP), W/m^{2}K (40)m = (39)m ÷ (4)

(40)m=	1.05	1.05	1.05	1.03	1.03	1.02	1.02	1.02	1.03	1.03	1.04	1.04	

Average = Sum(40)$_{1...12}$ /12= 1.03 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.66 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	107.17	103.27	99.38	95.48	91.58	87.69	87.69	91.58	95.48	99.38	103.27	107.17	

Total = Sum(44)$_{1...12}$ = 1169.14 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.93	139	143.44	125.05	119.99	103.54	95.95	110.1	111.42	129.85	141.74	153.92	

Total = Sum(45)$_{1...12}$ = 1532.93 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.84	20.85	21.52	18.76	18	15.53	14.39	16.52	16.71	19.48	21.26	23.09	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.53	181.09	190.03	170.15	166.59	148.64	142.54	156.7	156.51	176.44	186.83	200.51	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.53	181.09	190.03	170.15	166.59	148.64	142.54	156.7	156.51	176.44	186.83	200.51

Output from water heater (annual)$_{1…12}$ | 2081.55 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.12	79.89	84.97	77.65	77.17	70.5	69.18	73.88	73.12	80.45	83.2	88.45	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.31	19.82	16.12	12.2	9.12	7.7	8.32	10.82	14.52	18.43	21.51	22.93	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	244.15	246.69	240.3	226.71	209.55	193.43	182.66	180.12	186.51	200.1	217.26	233.38	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	(71)

Water heating gains (Table 5)

(72)m=	121.13	118.88	114.21	107.85	103.73	97.92	92.98	99.31	101.56	108.13	115.56	118.89	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	453.53	451.32	436.56	412.7	388.34	364.98	349.89	356.18	368.51	392.6	420.26	441.14	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	1.84	x	10.63	x	0.63	x	0.7	=	5.98	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.63	x	0.7	=	5.98	(74)
North	0.9x	0.77	x	4.6	x	10.63	x	0.63	x	0.7	=	14.95	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.63	x	0.7	=	11.43	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.63	x	0.7	=	11.43	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.63	x	0.7	=	28.57	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.63	x	0.7	=	19.42	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.63	x	0.7	=	19.42	(74)
North	0.9x	0.77	x	4.6	x	34.53	x	0.63	x	0.7	=	48.54	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.63	x	0.7	=	31.19	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.63	x	0.7	=	31.19	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.63	x	0.7	=	77.97	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.63	x	0.7	=	42.01	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.63	x	0.7	=	42.01	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.63	x	0.7	=	105.04	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.63	x	0.7	=	44.98	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.63	x	0.7	=	44.98	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.63	x	0.7	=	112.44	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.63	x	0.7	=	41.99	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.63	x	0.7	=	41.99	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.63	x	0.7	=	104.98	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.63	x	0.7	=	33.32	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.63	x	0.7	=	33.32	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.63	x	0.7	=	83.29	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.63	x	0.7	=	23.35	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.63	x	0.7	=	23.35	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.63	x	0.7	=	58.36	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.63	x	0.7	=	13.6	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.63	x	0.7	=	13.6	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.63	x	0.7	=	34.01	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.63	x	0.7	=	7.38	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.63	x	0.7	=	7.38	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.63	x	0.7	=	18.44	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.63	x	0.7	=	4.98	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.63	x	0.7	=	4.98	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.63	x	0.7	=	12.46	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	5.29	x	19.64	x	0.63	x	0.7	=	31.75	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.63	x	0.7	=	62.11	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)

West	0.9x	0.77	x	5.29	x	63.27	x	0.63	x	0.7	=	102.29	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.63	x	0.7	=	149.19	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.63	x	0.7	=	182.84	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.63	x	0.7	=	187.17	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.63	x	0.7	=	178.19	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.63	x	0.7	=	153.06	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.63	x	0.7	=	118.97	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.63	x	0.7	=	73.7	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.63	x	0.7	=	39.59	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.63	x	0.7	=	26.11	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	75.23	145.94	243.04	367.38	467.3	487.22	460.12	382.84	286.1	173.37	93.44	62.17	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	528.76	597.26	679.6	780.08	855.63	852.2	810.02	739.02	654.61	565.97	513.7	503.3	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.86	0.68	0.51	0.58	0.85	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.86	20	20.24	20.57	20.84	20.97	20.99	20.99	20.89	20.54	20.15	19.84	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.04	20.04	20.04	20.05	20.06	20.07	20.07	20.07	20.06	20.06	20.05	20.05	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.95	0.82	0.59	0.4	0.47	0.78	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.52	18.71	19.07	19.55	19.9	20.05	20.06	20.06	19.98	19.52	18.94	18.49	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.06	19.23	19.54	19.96	20.28	20.41	20.44	20.43	20.34	19.93	19.42	19.03	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.06	19.23	19.54	19.96	20.28	20.41	20.44	20.43	20.34	19.93	19.42	19.03	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.83	0.63	0.45	0.51	0.8	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	527.26	593.79	668.64	735.79	708.61	532.64	361.22	376.82	525.5	548.09	510.68	502.21	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1440.69	1395.26	1266.57	1061.68	821.66	551.19	363.62	381.62	594.23	893.42	1185.73	1433.85	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	679.59	538.59	444.86	234.64	84.11	0	0	0	0	256.93	486.03	693.14	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3417.89 (98)

Space heating requirement in kWh/m²/year 36.83 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	679.59	538.59	444.86	234.64	84.11	0	0	0	0	256.93	486.03	693.14	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	726.83	576.03	475.79	250.95	89.95	0	0	0	0	274.79	519.82	741.32	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3655.5 (211)

Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)													
	205.53	181.09	190.03	170.15	166.59	148.64	142.54	156.7	156.51	176.44	186.83	200.51	
Efficiency of water heater												79.8	(216)
(217)m=	87.77	87.55	87.01	85.67	83.1	79.8	79.8	79.8	79.8	85.82	87.25	87.86	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	234.17	206.85	218.41	198.6	200.47	186.26	178.63	196.36	196.13	205.61	214.13	228.23	

Total = Sum(219a)$_{1...12}$ = 2463.84 (219)

Annual totals	kWh/year	kWh/year
Space heating fuel used, main system 1		3655.5

Water heating fuel used		2463.84	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		394.08	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	789.59	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	532.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1321.78	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	204.53	(268)
Total CO2, kg/year		sum of (265)…(271) =		1565.23	(272)

TER = 16.86 (273)

BE CLEAN

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: a1-2-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.94	(1a) x	2.4	(2a) =	179.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.94	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	179.86	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.98	x1/[1/(1.2)+ 0.04]		=	6.85			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Floor			74.94	x	0.11	=	8.243401			(28)
Walls Type1	41.4	14.26	27.14	x	0.18	=	4.89			(29)
Walls Type2	10.58	2.1	8.48	x	0.18	=	1.53			(29)
Total area of elements, m²			126.92							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	33.5	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	13.31	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	46.81	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.49	76.49	76.49	76.49	76.49	76.49	76.49	76.49	76.49	76.49	76.49	76.49	

Average = $Sum(39)_{1...12}$ /12= 76.49 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	

Average = $Sum(40)_{1...12}$ /12= 1.02 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.36 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	99.27	95.66	92.05	88.44	84.83	81.22	81.22	84.83	88.44	92.05	95.66	99.27	

Total = $Sum(44)_{1...12}$ = 1082.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.22	128.76	132.87	115.83	111.15	95.91	88.88	101.99	103.2	120.27	131.29	142.57	

Total = $Sum(45)_{1...12}$ = 1419.93 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.08	19.31	19.93	17.38	16.67	14.39	13.33	15.3	15.48	18.04	19.69	21.39	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.49	178.68	188.14	169.33	166.42	149.4	144.15	157.26	156.7	175.55	184.78	197.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.49	178.68	188.14	169.33	166.42	149.4	144.15	157.26	156.7	175.55	184.78	197.85

Output from water heater (annual)$_{1…12}$ | 2070.77 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.17	82.75	88.4	81.31	81.18	74.69	73.77	78.13	77.11	84.21	86.45	91.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.61	16.53	13.44	10.17	7.61	6.42	6.94	9.02	12.1	15.37	17.94	19.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	208.54	210.71	205.25	193.64	178.99	165.22	156.01	153.85	159.3	170.91	185.57	199.34	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	(71)

Water heating gains (Table 5)

(72)m=	125.23	123.15	118.82	112.93	109.11	103.73	99.16	105.02	107.1	113.19	120.07	123.15	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	410.78	408.77	395.91	375.15	354.1	333.76	320.51	326.28	336.9	357.87	381.97	400.02	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.98	x	10.63	x	0.5	x	0.8	=	17.63	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)

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North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	5.98	x	20.32	x	0.5	x	0.8	=	33.69	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.98	x	34.53	x	0.5	x	0.8	=	57.24	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.98	x	55.46	x	0.5	x	0.8	=	91.94	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.98	x	74.72	x	0.5	x	0.8	=	123.85	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.98	x	79.99	x	0.5	x	0.8	=	132.59	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.98	x	74.68	x	0.5	x	0.8	=	123.79	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.98	x	59.25	x	0.5	x	0.8	=	98.21	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.98	x	41.52	x	0.5	x	0.8	=	68.82	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.98	x	24.19	x	0.5	x	0.8	=	40.1	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.98	x	13.12	x	0.5	x	0.8	=	21.74	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.98	x	8.86	x	0.5	x	0.8	=	14.69	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)

East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	48.92	94.17	158.48	247.41	324.7	343.55	322.38	261.3	188.65	111.99	60.55	40.62	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	459.7	502.95	554.39	622.56	678.8	677.31	642.89	587.58	525.55	469.86	442.52	440.63	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.87	0.69	0.52	0.58	0.85	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.95	20.06	20.28	20.58	20.84	20.97	20.99	20.99	20.9	20.57	20.2	19.92	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.99	0.95	0.82	0.6	0.41	0.47	0.78	0.97	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.66	18.83	19.14	19.57	19.91	20.04	20.06	20.06	19.98	19.56	19.03	18.61	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.18	19.32	19.6	19.97	20.28	20.41	20.44	20.43	20.35	19.96	19.5	19.13	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.18	19.32	19.6	19.97	20.28	20.41	20.44	20.43	20.35	19.96	19.5	19.13	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.83	0.63	0.45	0.52	0.8	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	457.88	499.39	544.83	587.91	565.11	428.79	291.34	304.25	422.5	453.12	439.03	439.24	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1137.88	1103.01	1001.83	846.94	656.52	444.68	293.42	308.45	477.78	716.12	948.28	1142.22	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	505.92	405.64	340.01	186.51	68.01	0	0	0	0	195.67	366.66	523.02	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2591.43 (98)

Space heating requirement in kWh/m²/year 34.58 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2591.43	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	2040.75	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	680.25	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2070.77	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1630.73	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	543.58	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	48.95	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		48.49	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	48.49	(331)
Energy for lighting (calculated in Appendix L)		328.59	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit				32	(361)
Heat efficiency of CHP unit				38	(362)
		Energy kWh/year	**Emission factor kg CO2/kWh**	**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	5370.4	x 0.22	1160.01	(363)

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less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1718.53	x	0.52		-891.92	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4291.4	x	0.22		926.94	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1373.25	x	0.52		-712.72	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	284.24	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	25.41	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	791.97	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					791.97	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	25.17	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	170.54	(379)
Total CO2, kg/year	sum of (376)…(382) =					987.67	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					13.18	(384)
EI rating (section 14)						88.97	(385)

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User Details:

Assessor Name: | **Stroma Number:**

Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-2-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.94	(1a) x	2.4	(2a) =	179.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.94	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	179.86	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.98	x1/[1/(1.4)+ 0.04]		=	7.93			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Floor			74.94	x	0.13	=	9.7422			(28)
Walls Type1	41.4	14.26	27.14	x	0.18	=	4.89			(29)
Walls Type2	10.58	2.1	8.48	x	0.18	=	1.53			(29)
Total area of elements, m²			126.92							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.16 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.66 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 48.82 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(38)m=	35.73	35.5	35.27	34.18	33.98	33.04	33.04	32.86	33.4	33.98	34.39	34.82	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	84.55	84.32	84.09	83.01	82.8	81.86	81.86	81.69	82.22	82.8	83.21	83.64	

Average = Sum(39)$_{1...12}$ /12= 83.01 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.13	1.13	1.12	1.11	1.1	1.09	1.09	1.09	1.1	1.1	1.11	1.12	

Average = Sum(40)$_{1...12}$ /12= 1.11 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.36 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	99.27	95.66	92.05	88.44	84.83	81.22	81.22	84.83	88.44	92.05	95.66	99.27	

Total = Sum(44)$_{1...12}$ = 1082.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.22	128.76	132.87	115.83	111.15	95.91	88.88	101.99	103.2	120.27	131.29	142.57	

Total = Sum(45)$_{1...12}$ = 1419.93 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.08	19.31	19.93	17.38	16.67	14.39	13.33	15.3	15.48	18.04	19.69	21.39	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	193.81	170.84	179.46	160.93	157.74	141	135.47	148.58	148.3	166.87	176.38	189.17	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	193.81	170.84	179.46	160.93	157.74	141	135.47	148.58	148.3	166.87	176.38	189.17

Output from water heater (annual)$_{1...12}$ | 1968.55 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.23	76.48	81.45	74.59	74.23	67.96	66.83	71.19	70.39	77.27	79.73	84.68	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.83	16.73	13.6	10.3	7.7	6.5	7.02	9.13	12.25	15.56	18.16	19.36	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	208.54	210.71	205.25	193.64	178.99	165.22	156.01	153.85	159.3	170.91	185.57	199.34	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	(71)

Water heating gains (Table 5)

(72)m=	115.89	113.81	109.48	103.6	99.77	94.39	89.82	95.68	97.76	103.85	110.73	113.82	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	404.67	402.64	389.74	368.94	347.86	327.51	314.26	320.06	330.72	351.72	375.86	393.91	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.98	x	10.63	x	0.63	x	0.7	=	19.43	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)

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North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	5.98	x	20.32	x	0.63	x	0.7	=	37.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	5.98	x	34.53	x	0.63	x	0.7	=	63.11	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	5.98	x	55.46	x	0.63	x	0.7	=	101.36	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	5.98	x	74.72	x	0.63	x	0.7	=	136.55	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	5.98	x	79.99	x	0.63	x	0.7	=	146.18	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	5.98	x	74.68	x	0.63	x	0.7	=	136.48	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	5.98	x	59.25	x	0.63	x	0.7	=	108.28	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	5.98	x	41.52	x	0.63	x	0.7	=	75.87	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	5.98	x	24.19	x	0.63	x	0.7	=	44.21	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	5.98	x	13.12	x	0.63	x	0.7	=	23.97	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	5.98	x	8.86	x	0.63	x	0.7	=	16.2	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)

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East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	53.94	103.83	174.73	272.77	357.98	378.76	355.42	288.08	207.98	123.47	66.76	44.78	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	458.61	506.47	564.46	641.71	705.84	706.27	669.68	608.14	538.7	475.19	442.61	438.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.87	0.69	0.53	0.6	0.86	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.8	19.93	20.17	20.51	20.81	20.96	20.99	20.98	20.87	20.5	20.1	19.78	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.98	19.98	19.99	20	20.01	20.01	20.01	20	20	19.99	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.99	0.95	0.83	0.61	0.41	0.48	0.79	0.97	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.38	18.56	18.92	19.42	19.81	19.98	20	20	19.89	19.41	18.82	18.36	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.95	19.11	19.42	19.85	20.21	20.37	20.4	20.4	20.28	19.84	19.33	18.93	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.95	19.11	19.42	19.85	20.21	20.37	20.4	20.4	20.28	19.84	19.33	18.93	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.95	0.84	0.64	0.46	0.53	0.81	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	456.79	502.87	554.83	606.58	591.16	451.67	307.98	320.49	438.53	459.18	439.22	437.3	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1238.41	1198.11	1086.24	909.27	704.29	472.38	311	326.38	508.5	765.52	1017.86	1231.76	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	581.53	467.2	395.37	217.94	84.17	0	0	0	0	227.92	416.62	591.07	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 2981.82 (98)

Space heating requirement in kWh/m²/year 39.79 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	581.53	467.2	395.37	217.94	84.17	0	0	0	0	227.92	416.62	591.07		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	621.95	499.68	422.86	233.09	90.02	0	0	0	0	243.76	445.59	632.16		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3189.11	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	193.81	170.84	179.46	160.93	157.74	141	135.47	148.58	148.3	166.87	176.38	189.17		
Efficiency of water heater													79.8	(216)
(217)m=	87.57	87.36	86.86	85.62	83.22	79.8	79.8	79.8	79.8	85.65	87.03	87.65		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	221.33	195.55	206.6	187.95	189.54	176.7	169.76	186.19	185.83	194.84	202.67	215.82		
Total = Sum(219a)$_{1...12}$ =													2332.78	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3189.11	
Water heating fuel used			2332.78	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			332.62	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	688.85	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	503.88	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1192.73	(265)

TER WorkSheet: New dwelling design stage

Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	172.63	(268)
Total CO2, kg/year		sum of (265)…(271) =		1404.28	(272)

TER = 18.74 (273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-2-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.81	(1a) x	2.4	(2a) =	129.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.81	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	129.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			6.44	x1/[1/(1.2)+ 0.04]		=	7.37			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Floor			53.81	x	0.11	=	5.9191			(28)
Walls Type1	19.19	9.2	9.99	x	0.18	=	1.8			(29)
Walls Type2	16.19	2.1	14.09	x	0.18	=	2.54			(29)
Total area of elements, m²			89.19							(31)
Party wall			35.3	x	0	=	0			(32)

* *for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

** *include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 23.31 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.98 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 33.29 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	21.31	21.31	21.31	21.31	21.31	21.31	21.31	21.31	21.31	21.31	21.31	21.31	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	

Average = Sum(39)$_{1\ldots12}$ /12= 54.6 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	

Average = Sum(40)$_{1\ldots12}$ /12= 1.01 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.8 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	84.71	81.63	78.55	75.47	72.39	69.31	69.31	72.39	75.47	78.55	81.63	84.71	

Total = Sum(44)$_{1\ldots12}$ = 924.09 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	125.62	109.87	113.37	98.84	94.84	81.84	75.84	87.02	88.06	102.63	112.03	121.66	

Total = Sum(45)$_{1\ldots12}$ = 1211.63 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.84	16.48	17.01	14.83	14.23	12.28	11.38	13.05	13.21	15.39	16.8	18.25	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	180.9	159.8	168.65	152.34	150.12	135.33	131.11	142.3	141.56	157.91	165.52	176.93	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	180.9	159.8	168.65	152.34	150.12	135.33	131.11	142.3	141.56	157.91	165.52	176.93	

Output from water heater (annual)$_{1\ldots12}$ | 1862.47 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.99	76.47	81.92	75.66	75.76	70.01	69.44	73.16	72.08	78.35	80.04	84.67	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.14	12.56	10.22	7.73	5.78	4.88	5.27	6.85	9.2	11.68	13.63	14.54	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	157.11	158.74	154.64	145.89	134.85	124.47	117.54	115.91	120.02	128.76	139.8	150.18	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	(71)

Water heating gains (Table 5)

(72)m=	115.58	113.8	110.11	105.08	101.82	97.23	93.33	98.33	100.11	105.3	111.17	113.81	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	336.87	335.14	324.99	308.74	292.49	276.62	266.18	271.13	279.36	295.79	314.65	328.56	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	6.44	x	19.64	x	0.5	x	0.8	=	35.06	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	6.44	x	38.42	x	0.5	x	0.8	=	68.59	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	6.44	x	63.27	x	0.5	x	0.8	=	112.95	(76)

East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	6.44	x	92.28	x	0.5	x	0.8	=	164.74	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	6.44	x	113.09	x	0.5	x	0.8	=	201.89	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	6.44	x	115.77	x	0.5	x	0.8	=	206.67	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	6.44	x	110.22	x	0.5	x	0.8	=	196.76	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	6.44	x	94.68	x	0.5	x	0.8	=	169.01	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	6.44	x	73.59	x	0.5	x	0.8	=	131.37	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	6.44	x	45.59	x	0.5	x	0.8	=	81.38	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	6.44	x	24.49	x	0.5	x	0.8	=	43.72	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	6.44	x	16.15	x	0.5	x	0.8	=	28.83	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	50.09	97.98	161.36	235.34	288.41	295.24	281.08	241.45	187.67	116.26	62.45	41.19	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.96	433.12	486.35	544.08	580.9	571.86	547.26	512.58	467.03	412.05	377.1	369.75	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.92	0.79	0.6	0.44	0.49	0.74	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.19	20.43	20.71	20.91	20.98	21	21	20.95	20.68	20.31	20.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.89	0.73	0.52	0.35	0.39	0.67	0.93	0.99	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.82	19.02	19.36	19.74	19.99	20.06	20.07	20.07	20.03	19.72	19.19	18.76	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.61	19.89	20.23	20.45	20.52	20.53	20.53	20.49	20.2	19.75	19.39	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.44	19.61	19.89	20.23	20.45	20.52	20.53	20.53	20.49	20.2	19.75	19.39	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.9	0.75	0.55	0.39	0.44	0.7	0.93	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	383.92	426.57	468.27	487.67	438.09	317.33	214.08	224.32	328.47	382.93	371.08	367.45	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	826.65	803.04	731.37	618.48	477.6	323.37	214.8	225.64	348.92	524.13	690.68	829.45	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	329.39	252.99	195.75	94.18	29.39	0	0	0	0	105.05	230.11	343.73	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1580.59 (98)

Space heating requirement in kWh/m²/year 29.37 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1580.59	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1244.72	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	414.91	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		1862.47	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1466.69	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	488.9	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	36.15	(313)

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Cooling System Energy Efficiency Ratio			0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =		0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside			34.82	(330a)
warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =		34.82	(331)
Energy for lighting (calculated in Appendix L)			249.76	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	3275.57	x	0.22		707.52	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1048.18	x	0.52		-544.01	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	3859.71	x	0.22		833.7	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1235.11	x	0.52		-641.02	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	209.92	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	18.76	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	584.87	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					584.87	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	18.07	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	129.62	(379)
Total CO2, kg/year	sum of (376)…(382) =					732.57	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					13.61	(384)
EI rating (section 14)						90.07	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-2-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.81	(1a) x	2.4	(2a) =	129.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.81	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	129.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			6.44	x1/[1/(1.4)+ 0.04]		=	8.54			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Floor			53.81	x	0.13	=	6.9953			(28)
Walls Type1	19.19	9.2	9.99	x	0.18	=	1.8			(29)
Walls Type2	16.19	2.1	14.09	x	0.18	=	2.54			(29)
Total area of elements, m²			89.19							(31)
Party wall			35.3	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.63 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.23 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 33.86 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.41	25.25	25.1	24.36	24.23	23.59	23.59	23.47	23.83	24.23	24.5	24.79	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	59.27	59.11	58.96	58.22	58.08	57.45	57.45	57.33	57.69	58.08	58.36	58.65	

Average = Sum(39)$_{1…12}$ /12= 58.22 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.1	1.1	1.1	1.08	1.08	1.07	1.07	1.07	1.07	1.08	1.08	1.09

Average = Sum(40)$_{1…12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.8 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	84.71	81.63	78.55	75.47	72.39	69.31	69.31	72.39	75.47	78.55	81.63	84.71	
										Total = Sum(44)$_{1…12}$ =		924.09	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	125.62	109.87	113.37	98.84	94.84	81.84	75.84	87.02	88.06	102.63	112.03	121.66	
										Total = Sum(45)$_{1…12}$ =		1211.63	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.84	16.48	17.01	14.83	14.23	12.28	11.38	13.05	13.21	15.39	16.8	18.25	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	172.21	151.95	159.97	143.93	141.44	126.93	122.43	133.62	133.16	149.22	157.12	168.25	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	172.21	151.95	159.97	143.93	141.44	126.93	122.43	133.62	133.16	149.22	157.12	168.25

Output from water heater (annual)$_{1...12}$ 1760.24 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	79.04	70.2	74.97	68.94	68.81	63.29	62.49	66.21	65.35	71.4	73.32	77.73	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.43	12.82	10.42	7.89	5.9	4.98	5.38	6.99	9.39	11.92	13.91	14.83	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	157.11	158.74	154.64	145.89	134.85	124.47	117.54	115.91	120.02	128.76	139.8	150.18	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	(71)

Water heating gains (Table 5)

(72)m=	106.24	104.46	100.77	95.75	92.49	87.9	83.99	88.99	90.77	95.97	101.84	104.47	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	330.82	329.06	318.87	302.57	286.27	270.39	259.95	264.93	273.21	289.69	308.59	322.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	6.44	x	19.64	x	0.63	x	0.7	=	38.65	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	6.44	x	38.42	x	0.63	x	0.7	=	75.62	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	6.44	x	63.27	x	0.63	x	0.7	=	124.53	(76)

East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	6.44	x	92.28	x	0.63	x	0.7	=	181.62	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	6.44	x	113.09	x	0.63	x	0.7	=	222.58	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	6.44	x	115.77	x	0.63	x	0.7	=	227.85	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	6.44	x	110.22	x	0.63	x	0.7	=	216.93	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	6.44	x	94.68	x	0.63	x	0.7	=	186.34	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	6.44	x	73.59	x	0.63	x	0.7	=	144.83	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	6.44	x	45.59	x	0.63	x	0.7	=	89.73	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	6.44	x	24.49	x	0.63	x	0.7	=	48.2	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	6.44	x	16.15	x	0.63	x	0.7	=	31.79	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	55.22	108.02	177.9	259.46	317.98	325.5	309.89	266.19	206.91	128.18	68.85	45.41	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.05	437.09	496.77	562.02	604.25	595.89	569.85	531.13	480.12	417.87	377.45	367.93	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.92	0.79	0.6	0.44	0.49	0.75	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.09	20.35	20.67	20.89	20.98	21	20.99	20.94	20.63	20.23	19.91	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20	20	20.02	20.02	20.03	20.03	20.03	20.02	20.02	20.01	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.89	0.73	0.52	0.34	0.39	0.67	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.59	18.81	19.19	19.64	19.92	20.02	20.03	20.03	19.98	19.61	19.03	18.56	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.26	19.45	19.77	20.15	20.4	20.5	20.51	20.51	20.46	20.12	19.63	19.23	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(93)m=		19.26	19.45	19.77	20.15	20.4	20.5	20.51	20.51	20.46	20.12	19.63	19.23		(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.99	0.96	0.9	0.76	0.56	0.39	0.44	0.71	0.93	0.98	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	383.15	430.69	478.8	504.52	457.83	331.41	223.75	233.95	341.43	389.87	371.75	365.74		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	886.79	860.03	782.19	655.25	505.5	338.8	224.71	235.66	366.7	553.05	731.13	881.77		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	374.71	288.52	225.72	108.53	35.47	0	0	0	0	121.41	258.75	383.92		
Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =													1797.03	(98)
Space heating requirement in kWh/m²/year													33.4	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	374.71	288.52	225.72	108.53	35.47	0	0	0	0	121.41	258.75	383.92		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	400.76	308.58	241.42	116.07	37.93	0	0	0	0	129.85	276.74	410.61		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1921.96	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)														
	172.21	151.95	159.97	143.93	141.44	126.93	122.43	133.62	133.16	149.22	157.12	168.25		
Efficiency of water heater													79.8	(216)
(217)m=	86.83	86.5	85.73	84.07	81.74	79.8	79.8	79.8	79.8	84.27	86.14	86.95		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	198.33	175.67	186.59	171.2	173.04	159.06	153.42	167.44	166.86	177.08	182.41	193.51		
Total = Sum(219a)$_{1...12}$ =													2104.62	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1921.96

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Water heating fuel used			2104.62	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			254.86	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	415.14	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	454.6	(264)
Space and water heating	(261) + (262) + (263) + (264) =			869.74	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	132.27	(268)
Total CO2, kg/year		sum of (265)…(271) =		1040.94	(272)

TER =	19.34	(273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-2-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.35	(1a) x	2.4	(2a) =	176.04	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.35	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.04	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.06	x1/[1/(1.2)+ 0.04]		=	5.79			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Floor			73.35	x	0.11	=	8.0685			(28)
Walls Type1	41.75	10.58	31.17	x	0.18	=	5.61			(29)
Walls Type2	13.03	2.1	10.93	x	0.18	=	1.97			(29)
Total area of elements, m²			128.13							(31)
Party wall			28.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.04 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 42.32 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.05	29.05	29.05	29.05	29.05	29.05	29.05	29.05	29.05	29.05	29.05	29.05	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	71.37	71.37	71.37	71.37	71.37	71.37	71.37	71.37	71.37	71.37	71.37	71.37	

Average = Sum(39)$_{1…12}$ /12= 71.37 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97

Average = Sum(40)$_{1…12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.32 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.41 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.35	94.77	91.2	87.62	84.05	80.47	80.47	84.05	87.62	91.2	94.77	98.35	
										Total = Sum(44)$_{1…12}$ =		1072.92	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	145.85	127.56	131.63	114.76	110.12	95.02	88.05	101.04	102.25	119.16	130.07	141.25	
										Total = Sum(45)$_{1…12}$ =		1406.77	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	21.88	19.13	19.75	17.21	16.52	14.25	13.21	15.16	15.34	17.87	19.51	21.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.13	177.49	186.91	168.25	165.39	148.52	143.33	156.32	155.74	174.44	183.57	196.53	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.13	177.49	186.91	168.25	165.39	148.52	143.33	156.32	155.74	174.44	183.57	196.53	

Output from water heater (annual)1…12 2057.61 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.72	82.36	87.99	80.95	80.84	74.39	73.5	77.82	76.79	83.84	86.04	91.19	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.96	16.84	13.69	10.37	7.75	6.54	7.07	9.19	12.33	15.66	18.28	19.48	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	204.99	207.11	201.75	190.34	175.94	162.4	153.35	151.23	156.59	168	182.4	195.94	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	(71)

Water heating gains (Table 5)

(72)m=	124.62	122.55	118.27	112.43	108.65	103.32	98.79	104.59	106.66	112.69	119.51	122.56	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	406.43	404.37	391.58	371.01	350.2	330.13	317.08	322.88	333.44	354.22	378.05	395.86	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.06	x	19.64	x	0.5	x	0.8	=	27.55	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	5.06	x	38.42	x	0.5	x	0.8	=	53.89	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	5.06	x	63.27	x	0.5	x	0.8	=	88.75	(76)

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East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	5.06	x	92.28	x	0.5	x	0.8	=	129.44	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	5.06	x	113.09	x	0.5	x	0.8	=	158.63	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	5.06	x	115.77	x	0.5	x	0.8	=	162.38	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	5.06	x	110.22	x	0.5	x	0.8	=	154.6	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	5.06	x	94.68	x	0.5	x	0.8	=	132.8	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	5.06	x	73.59	x	0.5	x	0.8	=	103.22	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	5.06	x	45.59	x	0.5	x	0.8	=	63.94	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	5.06	x	24.49	x	0.5	x	0.8	=	34.35	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	5.06	x	16.15	x	0.5	x	0.8	=	22.65	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	78.34	141.86	211.78	284.37	333.04	335.53	321.56	285.48	237.47	162.01	95.48	65.92	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	484.77	546.24	603.36	655.39	683.24	665.66	638.64	608.36	570.91	516.22	473.54	461.78	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.84	0.66	0.49	0.53	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.2	20.41	20.67	20.88	20.98	21	20.99	20.94	20.67	20.31	20.02	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.92	0.79	0.58	0.39	0.43	0.71	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.86	19.05	19.36	19.73	19.99	20.09	20.1	20.1	20.06	19.73	19.22	18.8	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.34	19.51	19.78	20.11	20.35	20.44	20.46	20.46	20.41	20.11	19.65	19.29	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.34	19.51	19.78	20.11	20.35	20.44	20.46	20.46	20.41	20.11	19.65	19.29	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.92	0.81	0.61	0.43	0.47	0.74	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	482.03	539.87	586.29	604.55	550.29	406.11	274.33	287.6	420.03	485.87	467.78	459.76	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1073.23	1042.66	948.03	799.76	617.12	417.13	275.57	289.74	450.44	678.62	895.88	1076.8	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	439.86	337.87	269.13	140.55	49.72	0	0	0	0	143.4	308.23	459.08	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2147.84 (98)

Space heating requirement in kWh/m²/year 29.28 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating	**kWh/year**
Annual space heating requirement	2147.84

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Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1691.42	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	563.81	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2057.61	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1620.37	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	540.12	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	44.16	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.46	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	47.46	(331)
Energy for lighting (calculated in Appendix L)		334.76	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4451.11	x	0.22		961.44	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1424.35	x	0.52		-739.24	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4264.12	x	0.22		921.05	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1364.52	x	0.52		-708.19	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	256.4	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	22.92	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	714.38	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					714.38	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	24.63	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	173.74	(379)
Total CO2, kg/year	sum of (376)…(382) =					912.75	(383)

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Dwelling CO2 Emission Rate	(383) ÷ (4) =	12.44	(384)
EI rating (section 14)		89.67	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: a1-2-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.35	(1a) x	2.4	(2a) =	176.04	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.35	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.04	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.06	x1/[1/(1.4)+ 0.04]		=	6.71			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Floor			73.35	x	0.13	=	9.5355			(28)
Walls Type1	41.75	10.58	31.17	x	0.18	=	5.61			(29)
Walls Type2	13.03	2.1	10.93	x	0.18	=	1.97			(29)
Total area of elements, m²			128.13							(31)
Party wall			28.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.24 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.01 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 44.25 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.08	34.84	34.61	33.53	33.33	32.39	32.39	32.22	32.76	33.33	33.74	34.17	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	79.33	79.09	78.86	77.79	77.58	76.65	76.65	76.47	77.01	77.58	77.99	78.42	

Average = Sum(39)$_{1\ldots12}$ /12= 77.78 (39)

TER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.08	1.08	1.08	1.06	1.06	1.04	1.04	1.04	1.05	1.06	1.06	1.07	

Average = Sum(40)$_{1…12}$ /12= 1.06 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.32 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.41 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	98.35	94.77	91.2	87.62	84.05	80.47	80.47	84.05	87.62	91.2	94.77	98.35	

Total = Sum(44)$_{1…12}$ = 1072.92 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	145.85	127.56	131.63	114.76	110.12	95.02	88.05	101.04	102.25	119.16	130.07	141.25	

Total = Sum(45)$_{1…12}$ = 1406.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	21.88	19.13	19.75	17.21	16.52	14.25	13.21	15.16	15.34	17.87	19.51	21.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	192.45	169.65	178.23	159.85	156.71	140.11	134.65	147.64	147.34	165.75	175.16	187.84	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	192.45	169.65	178.23	159.85	156.71	140.11	134.65	147.64	147.34	165.75	175.16	187.84	

Output from water heater (annual)$_{1...12}$ 1955.39 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.77	76.08	81.04	74.23	73.89	67.67	66.55	70.87	70.07	76.9	79.32	84.24	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	19.48	17.3	14.07	10.65	7.96	6.72	7.26	9.44	12.67	16.09	18.78	20.02	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	204.99	207.11	201.75	190.34	175.94	162.4	153.35	151.23	156.59	168	182.4	195.94	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	(71)
Water heating gains (Table 5)													
(72)m=	115.28	113.22	108.93	103.1	99.31	93.98	89.45	95.26	97.32	103.36	110.17	113.23	(72)
Total internal gains =						(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m							
(73)m=	400.62	398.5	385.62	364.96	344.08	323.97	310.94	316.8	327.45	348.31	372.22	390.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.06	x	19.64	x	0.63	x	0.7	=	30.37	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	5.06	x	38.42	x	0.63	x	0.7	=	59.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	5.06	x	63.27	x	0.63	x	0.7	=	97.85	(76)

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East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	5.06	x	92.28	x	0.63	x	0.7	=	142.7	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	5.06	x	113.09	x	0.63	x	0.7	=	174.89	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	5.06	x	115.77	x	0.63	x	0.7	=	179.03	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	5.06	x	110.22	x	0.63	x	0.7	=	170.44	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	5.06	x	94.68	x	0.63	x	0.7	=	146.41	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	5.06	x	73.59	x	0.63	x	0.7	=	113.8	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	5.06	x	45.59	x	0.63	x	0.7	=	70.5	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	5.06	x	24.49	x	0.63	x	0.7	=	37.87	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	5.06	x	16.15	x	0.63	x	0.7	=	24.98	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.37	156.41	233.49	313.52	367.17	369.93	354.52	314.74	261.81	178.61	105.27	72.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	486.99	554.91	619.11	678.48	711.26	693.9	665.46	631.54	589.26	526.93	477.49	462.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.85	0.67	0.5	0.55	0.8	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.91	20.06	20.3	20.61	20.85	20.97	20.99	20.99	20.92	20.61	20.21	19.89	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.02	20.02	20.02	20.03	20.04	20.05	20.05	20.05	20.04	20.04	20.03	20.03	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.8	0.59	0.4	0.44	0.72	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.57	18.79	19.14	19.58	19.89	20.03	20.04	20.04	19.98	19.59	19.01	18.54	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.11	19.3	19.61	19.99	20.27	20.4	20.42	20.42	20.36	20	19.49	19.08	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.11	19.3	19.61	19.99	20.27	20.4	20.42	20.42	20.36	20	19.49	19.08	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.92	0.81	0.62	0.44	0.48	0.75	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	484.25	548.51	602.08	627.52	578.62	429.6	291.19	304.48	440.98	497.76	471.88	460.71	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1174.55	1138.93	1033.7	862.78	665.02	444.72	293.11	307.66	481.75	729.1	966.23	1166.89	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	513.58	396.76	321.12	169.38	64.28	0	0	0	0	172.12	355.93	525.4	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2518.56 (98)

Space heating requirement in kWh/m²/year 34.34 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	513.58	396.76	321.12	169.38	64.28	0	0	0	0	172.12	355.93	525.4	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	549.28	424.34	343.45	181.16	68.75	0	0	0	0	184.08	380.67	561.92	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2693.65 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

192.45	169.65	178.23	159.85	156.71	140.11	134.65	147.64	147.34	165.75	175.16	187.84

Efficiency of water heater 79.8 (216)

(217)m=	87.31	87.01	86.37	84.97	82.64	79.8	79.8	79.8	79.8	84.91	86.67	87.41	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	220.42	194.99	206.36	188.13	189.63	175.58	168.73	185.01	184.64	195.2	202.11	214.89

Total = Sum(219a)$_{1...12}$ = 2325.69 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2693.65	
Water heating fuel used		2325.69	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		344.01	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	581.83	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	502.35	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1084.18	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	178.54	(268)
Total CO2, kg/year			sum of (265)…(271) =		1301.64	(272)

TER = 17.75 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-2-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	72.42	(1a) x	2.4	(2a) =	173.81	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		173.81	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			5.98	x1/[1/(1.2)+ 0.04]		=	6.85			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Floor			72.42	x	0.11	=	7.9662			(28)
Walls Type1	46.63	16.1	30.53	x	0.18	=	5.5			(29)
Walls Type2	26.01	2.1	23.91	x	0.18	=	4.3			(29)
Total area of elements, m²			145.06							(31)
Party wall			20.62	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.72 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.27 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 52.99 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	81.67	81.67	81.67	81.67	81.67	81.67	81.67	81.67	81.67	81.67	81.67	81.67	

Average = Sum(39)$_{1\ldots12}$ /12= 81.67 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	

Average = Sum(40)$_{1\ldots12}$ /12= 1.13 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.3 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.91 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	97.8	94.24	90.68	87.13	83.57	80.02	80.02	83.57	87.13	90.68	94.24	97.8	

Total = Sum(44)$_{1\ldots12}$ = 1066.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.03	126.84	130.89	114.11	109.5	94.49	87.56	100.47	101.67	118.49	129.34	140.45	

Total = Sum(45)$_{1\ldots12}$ = 1398.84 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.75	19.03	19.63	17.12	16.42	14.17	13.13	15.07	15.25	17.77	19.4	21.07	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	200.31	176.77	186.17	167.61	164.77	147.98	142.83	155.75	155.16	173.76	182.83	195.73	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	200.31	176.77	186.17	167.61	164.77	147.98	142.83	155.75	155.16	173.76	182.83	195.73

Output from water heater (annual)$_{1...12}$ | 2049.68 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.44	82.12	87.74	80.74	80.63	74.21	73.33	77.63	76.6	83.62	85.8	90.92	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.09	16.06	13.06	9.89	7.39	6.24	6.74	8.77	11.77	14.94	17.44	18.59	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	202.88	204.98	199.68	188.38	174.13	160.73	151.78	149.67	154.98	166.27	180.53	193.93	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	(71)

Water heating gains (Table 5)

(72)m=	124.25	122.2	117.93	112.14	108.37	103.07	98.57	104.34	106.39	112.39	119.17	122.21	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	402.77	400.8	388.23	367.96	347.44	327.59	314.64	320.33	330.68	351.15	374.68	392.27	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

South	0.9x	0.77	x	5.98	x	46.75	x	0.5	x	0.8	=	77.5	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	5.98	x	76.57	x	0.5	x	0.8	=	126.92	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	5.98	x	97.53	x	0.5	x	0.8	=	161.68	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	5.98	x	110.23	x	0.5	x	0.8	=	182.73	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	5.98	x	114.87	x	0.5	x	0.8	=	190.42	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	5.98	x	110.55	x	0.5	x	0.8	=	183.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	5.98	x	108.01	x	0.5	x	0.8	=	179.05	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	5.98	x	104.89	x	0.5	x	0.8	=	173.88	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	5.98	x	101.89	x	0.5	x	0.8	=	168.89	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	5.98	x	82.59	x	0.5	x	0.8	=	136.9	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	5.98	x	55.42	x	0.5	x	0.8	=	91.86	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	5.98	x	40.4	x	0.5	x	0.8	=	66.97	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)

West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	153.34	263.89	365.39	455.34	509.03	504.02	486.55	447.29	396.98	293.09	184.22	130.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	556.11	664.69	753.62	823.3	856.48	831.61	801.19	767.62	727.66	644.25	558.91	523.1	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.78	0.61	0.44	0.48	0.71	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.94	20.14	20.4	20.68	20.88	20.97	21	20.99	20.94	20.67	20.24	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.87	0.72	0.52	0.34	0.38	0.63	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.59	18.87	19.24	19.62	19.87	19.96	19.98	19.98	19.94	19.62	19.02	18.51	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.13	19.38	19.71	20.05	20.28	20.37	20.38	20.38	20.34	20.04	19.51	19.06	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

DER WorkSheet: New dwelling design stage

(93)m=	19.13	19.38	19.71	20.05	20.28	20.37	20.38	20.38	20.34	20.04	19.51	19.06	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.88	0.74	0.55	0.38	0.42	0.66	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	550.4	648.84	712.61	720.52	635.79	459.45	307.58	322.91	481.64	580.71	546.56	519.03	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1211.15	1182.45	1078.54	910.27	700.41	471.02	309.05	325.26	509.59	771.13	1013.21	1213.89	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	491.6	358.58	272.25	136.62	48.08	0	0	0	0	141.67	335.99	516.98	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2301.77 (98)

Space heating requirement in kWh/m²/year 31.78 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2301.77	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1812.64	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	604.21	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2049.68	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1614.12	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	538.04	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	45.69	(313)

DER WorkSheet: New dwelling design stage

Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.86	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	46.86	(331)
Energy for lighting (calculated in Appendix L)		319.42	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4770.11	x	0.22		1030.34	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1526.43	x	0.52		-792.22	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4247.69	x	0.22		917.5	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1359.26	x	0.52		-705.46	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	265.3	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	23.71	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	739.18	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					739.18	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	24.32	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	165.78	(379)
Total CO2, kg/year	sum of (376)…(382) =					929.28	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					12.83	(384)
EI rating (section 14)						89.4	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-2-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	72.42	(1a) x	2.4	(2a) =	173.81	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.42	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	173.81	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.74	x1/[1/(1.4)+ 0.04]		=	3.63			(27)
Windows Type 2			5.94	x1/[1/(1.4)+ 0.04]		=	7.87			(27)
Windows Type 3			2.74	x1/[1/(1.4)+ 0.04]		=	3.63			(27)
Windows Type 4			1.83	x1/[1/(1.4)+ 0.04]		=	2.43			(27)
Windows Type 5			2.74	x1/[1/(1.4)+ 0.04]		=	3.63			(27)
Floor			72.42	x	0.13	=	9.414599			(28)
Walls Type1	46.63	15.99	30.64	x	0.18	=	5.52			(29)
Walls Type2	26.01	2.1	23.91	x	0.18	=	4.3			(29)
Total area of elements, m²			145.06							(31)
Party wall			20.62	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.53 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 13.88 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 56.41 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.69	34.46	34.23	33.16	32.95	32.02	32.02	31.84	32.38	32.95	33.36	33.79	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	91.1	90.87	90.64	89.57	89.36	88.43	88.43	88.25	88.79	89.36	89.77	90.2	

Average = Sum(39)$_{1…12}$ /12= 89.57 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.26	1.25	1.25	1.24	1.23	1.22	1.22	1.22	1.23	1.23	1.24	1.25

Average = Sum(40)$_{1…12}$ /12= 1.24 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.3 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.91 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.8	94.24	90.68	87.13	83.57	80.02	80.02	83.57	87.13	90.68	94.24	97.8

Total = Sum(44)$_{1…12}$ = 1066.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.03	126.84	130.89	114.11	109.5	94.49	87.56	100.47	101.67	118.49	129.34	140.45

Total = Sum(45)$_{1…12}$ = 1398.84 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.75	19.03	19.63	17.12	16.42	14.17	13.13	15.07	15.25	17.77	19.4	21.07	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.62	168.93	177.49	159.21	156.09	139.58	134.15	147.07	146.76	165.08	174.43	187.05	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.62	168.93	177.49	159.21	156.09	139.58	134.15	147.07	146.76	165.08	174.43	187.05

Output from water heater (annual)$_{1…12}$ — 1947.46 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.5	75.84	80.8	74.02	73.68	67.49	66.39	70.68	69.88	76.67	79.08	83.98	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.09	16.07	13.07	9.89	7.4	6.24	6.75	8.77	11.77	14.94	17.44	18.59	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	202.88	204.98	199.68	188.38	174.13	160.73	151.78	149.67	154.98	166.27	180.53	193.93	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	(71)

Water heating gains (Table 5)

(72)m=	114.92	112.86	108.6	102.8	99.04	93.74	89.23	95	97.05	103.06	109.83	112.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	396.44	394.47	381.9	361.63	341.11	321.26	308.31	313.99	324.35	344.82	368.35	385.94	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	5.94	x	46.75	x	0.63	x	0.7	=	84.87	(78)
South	0.9x	0.77	x	2.74	x	46.75	x	0.63	x	0.7	=	39.15	(78)
South	0.9x	0.77	x	5.94	x	76.57	x	0.63	x	0.7	=	139	(78)
South	0.9x	0.77	x	2.74	x	76.57	x	0.63	x	0.7	=	64.12	(78)
South	0.9x	0.77	x	5.94	x	97.53	x	0.63	x	0.7	=	177.06	(78)
South	0.9x	0.77	x	2.74	x	97.53	x	0.63	x	0.7	=	81.67	(78)
South	0.9x	0.77	x	5.94	x	110.23	x	0.63	x	0.7	=	200.11	(78)
South	0.9x	0.77	x	2.74	x	110.23	x	0.63	x	0.7	=	92.31	(78)
South	0.9x	0.77	x	5.94	x	114.87	x	0.63	x	0.7	=	208.53	(78)
South	0.9x	0.77	x	2.74	x	114.87	x	0.63	x	0.7	=	96.19	(78)
South	0.9x	0.77	x	5.94	x	110.55	x	0.63	x	0.7	=	200.68	(78)
South	0.9x	0.77	x	2.74	x	110.55	x	0.63	x	0.7	=	92.57	(78)
South	0.9x	0.77	x	5.94	x	108.01	x	0.63	x	0.7	=	196.08	(78)
South	0.9x	0.77	x	2.74	x	108.01	x	0.63	x	0.7	=	90.45	(78)
South	0.9x	0.77	x	5.94	x	104.89	x	0.63	x	0.7	=	190.42	(78)
South	0.9x	0.77	x	2.74	x	104.89	x	0.63	x	0.7	=	87.84	(78)
South	0.9x	0.77	x	5.94	x	101.89	x	0.63	x	0.7	=	184.96	(78)
South	0.9x	0.77	x	2.74	x	101.89	x	0.63	x	0.7	=	85.32	(78)
South	0.9x	0.77	x	5.94	x	82.59	x	0.63	x	0.7	=	149.92	(78)
South	0.9x	0.77	x	2.74	x	82.59	x	0.63	x	0.7	=	69.16	(78)
South	0.9x	0.77	x	5.94	x	55.42	x	0.63	x	0.7	=	100.6	(78)
South	0.9x	0.77	x	2.74	x	55.42	x	0.63	x	0.7	=	46.41	(78)
South	0.9x	0.77	x	5.94	x	40.4	x	0.63	x	0.7	=	73.34	(78)
South	0.9x	0.77	x	2.74	x	40.4	x	0.63	x	0.7	=	33.83	(78)
West	0.9x	0.77	x	2.74	x	19.64	x	0.63	x	0.7	=	16.45	(80)
West	0.9x	0.77	x	1.83	x	19.64	x	0.63	x	0.7	=	10.98	(80)
West	0.9x	0.77	x	2.74	x	19.64	x	0.63	x	0.7	=	16.45	(80)
West	0.9x	0.77	x	2.74	x	38.42	x	0.63	x	0.7	=	32.17	(80)
West	0.9x	0.77	x	1.83	x	38.42	x	0.63	x	0.7	=	21.49	(80)
West	0.9x	0.77	x	2.74	x	38.42	x	0.63	x	0.7	=	32.17	(80)
West	0.9x	0.77	x	2.74	x	63.27	x	0.63	x	0.7	=	52.98	(80)
West	0.9x	0.77	x	1.83	x	63.27	x	0.63	x	0.7	=	35.39	(80)
West	0.9x	0.77	x	2.74	x	63.27	x	0.63	x	0.7	=	52.98	(80)
West	0.9x	0.77	x	2.74	x	92.28	x	0.63	x	0.7	=	77.27	(80)
West	0.9x	0.77	x	1.83	x	92.28	x	0.63	x	0.7	=	51.61	(80)
West	0.9x	0.77	x	2.74	x	92.28	x	0.63	x	0.7	=	77.27	(80)
West	0.9x	0.77	x	2.74	x	113.09	x	0.63	x	0.7	=	94.7	(80)
West	0.9x	0.77	x	1.83	x	113.09	x	0.63	x	0.7	=	63.25	(80)
West	0.9x	0.77	x	2.74	x	113.09	x	0.63	x	0.7	=	94.7	(80)
West	0.9x	0.77	x	2.74	x	115.77	x	0.63	x	0.7	=	96.94	(80)
West	0.9x	0.77	x	1.83	x	115.77	x	0.63	x	0.7	=	64.75	(80)

West	0.9x	0.77	x	2.74	x	115.77	x	0.63	x	0.7	=	96.94	(80)
West	0.9x	0.77	x	2.74	x	110.22	x	0.63	x	0.7	=	92.29	(80)
West	0.9x	0.77	x	1.83	x	110.22	x	0.63	x	0.7	=	61.64	(80)
West	0.9x	0.77	x	2.74	x	110.22	x	0.63	x	0.7	=	92.29	(80)
West	0.9x	0.77	x	2.74	x	94.68	x	0.63	x	0.7	=	79.28	(80)
West	0.9x	0.77	x	1.83	x	94.68	x	0.63	x	0.7	=	52.95	(80)
West	0.9x	0.77	x	2.74	x	94.68	x	0.63	x	0.7	=	79.28	(80)
West	0.9x	0.77	x	2.74	x	73.59	x	0.63	x	0.7	=	61.62	(80)
West	0.9x	0.77	x	1.83	x	73.59	x	0.63	x	0.7	=	41.16	(80)
West	0.9x	0.77	x	2.74	x	73.59	x	0.63	x	0.7	=	61.62	(80)
West	0.9x	0.77	x	2.74	x	45.59	x	0.63	x	0.7	=	38.18	(80)
West	0.9x	0.77	x	1.83	x	45.59	x	0.63	x	0.7	=	25.5	(80)
West	0.9x	0.77	x	2.74	x	45.59	x	0.63	x	0.7	=	38.18	(80)
West	0.9x	0.77	x	2.74	x	24.49	x	0.63	x	0.7	=	20.51	(80)
West	0.9x	0.77	x	1.83	x	24.49	x	0.63	x	0.7	=	13.7	(80)
West	0.9x	0.77	x	2.74	x	24.49	x	0.63	x	0.7	=	20.51	(80)
West	0.9x	0.77	x	2.74	x	16.15	x	0.63	x	0.7	=	13.52	(80)
West	0.9x	0.77	x	1.83	x	16.15	x	0.63	x	0.7	=	9.03	(80)
West	0.9x	0.77	x	2.74	x	16.15	x	0.63	x	0.7	=	13.52	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	167.9	288.95	400.08	498.58	557.37	551.89	532.76	489.76	434.67	320.92	201.72	143.25	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	564.33	683.41	781.98	860.21	898.48	873.15	841.06	803.76	759.03	665.75	570.07	529.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.91	0.79	0.62	0.46	0.5	0.73	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.78	19.99	20.29	20.61	20.85	20.97	20.99	20.99	20.92	20.61	20.13	19.74	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.87	19.88	19.88	19.89	19.89	19.9	19.9	19.91	19.9	19.89	19.89	19.88	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.88	0.73	0.52	0.35	0.38	0.64	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.27	18.59	19	19.46	19.75	19.88	19.9	19.9	19.84	19.46	18.79	18.22	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.88	19.15	19.52	19.92	20.19	20.32	20.34	20.34	20.28	19.92	19.32	18.83	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.88	19.15	19.52	19.92	20.19	20.32	20.34	20.34	20.28	19.92	19.32	18.83	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.88	0.75	0.56	0.39	0.43	0.67	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	558.37	666.86	739.76	754.81	673.82	489.21	328.24	343.9	510.35	602.13	557.44	524.91	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1327.89	1294.98	1179.83	987.07	758.87	505.39	330.54	347.45	548.39	832.97	1097.3	1319.67	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	572.52	422.09	327.42	167.23	63.28	0	0	0	0	171.74	388.7	591.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2704.28 (98)

Space heating requirement in kWh/m²/year 37.34 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	572.52	422.09	327.42	167.23	63.28	0	0	0	0	171.74	388.7	591.3		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	612.32	451.43	350.18	178.86	67.68	0	0	0	0	183.68	415.72	632.4		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2892.28	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	191.62	168.93	177.49	159.21	156.09	139.58	134.15	147.07	146.76	165.08	174.43	187.05		
Efficiency of water heater													79.8	(216)
(217)m=	87.56	87.16	86.43	84.95	82.62	79.8	79.8	79.8	79.8	84.92	86.89	87.67		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	218.86	193.82	205.36	187.42	188.93	174.91	168.11	184.29	183.91	194.4	200.75	213.34		
Total = Sum(219a)$_{1...12}$ =													2314.1	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2892.28

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Water heating fuel used			2314.1	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			319.49	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	624.73	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	499.85	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1124.58	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	165.82	(268)
Total CO2, kg/year		sum of (265)…(271) =		1329.32	(272)

TER = 18.36 (273)

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User Details:

Assessor Name: | **Stroma Number:**

Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-2-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	120.39	(1a) x	2.4	(2a) =	288.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	120.39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	288.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			3.68	x1/[1/(1.2)+ 0.04]		=	4.21			(27)
Windows Type 2			5.06	x1/[1/(1.2)+ 0.04]		=	5.79			(27)
Windows Type 3			3.22	x1/[1/(1.2)+ 0.04]		=	3.69			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Floor			120.39	x	0.11	=	13.2429			(28)
Walls Type1	32.79	17.48	15.31	x	0.18	=	2.76			(29)
Walls Type2	25.04	2.1	22.94	x	0.18	=	4.13			(29)
Total area of elements, m²			178.22							(31)
Party wall			61.8	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.66 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.22 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 57.88 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	105.55	

Average = Sum(39)$_{1…12}$ /12= 105.55 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	

Average = Sum(40)$_{1…12}$ /12= 0.88 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.86 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 102.24 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	112.46	108.37	104.28	100.19	96.1	92.02	92.02	96.1	100.19	104.28	108.37	112.46	

Total = Sum(44)$_{1…12}$ = 1226.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.78	145.87	150.52	131.23	125.92	108.66	100.69	115.54	116.92	136.26	148.74	161.52	

Total = Sum(45)$_{1…12}$ = 1608.62 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.02	21.88	22.58	19.68	18.89	16.3	15.1	17.33	17.54	20.44	22.31	24.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	222.06	195.79	205.8	184.72	181.19	162.15	155.96	170.82	170.41	191.53	202.23	216.79	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	222.06	195.79	205.8	184.72	181.19	162.15	155.96	170.82	170.41	191.53	202.23	216.79

Output from water heater (annual)$_{1...12}$ — 2259.46 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	99.68	88.44	94.27	86.43	86.09	78.92	77.7	82.64	81.67	89.53	92.25	97.93	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	26.39	23.44	19.06	14.43	10.79	9.11	9.84	12.79	17.17	21.8	25.44	27.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	285.72	288.68	281.21	265.31	245.23	226.36	213.75	210.79	218.26	234.16	254.24	273.11	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	(71)

Water heating gains (Table 5)

(72)m=	133.97	131.61	126.71	120.04	115.71	109.62	104.43	111.07	113.43	120.33	128.12	131.62	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	512.05	509.71	492.95	465.75	437.7	411.05	394	400.62	414.83	442.27	473.78	497.83	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	3.68	x	10.63	x	0.5	x	0.8	=	10.85	(74)
North	0.9x	0.77	x	5.06	x	10.63	x	0.5	x	0.8	=	14.91	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	3.68	x	20.32	x	0.5	x	0.8	=	20.73	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.5	x	0.8	=	28.5	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	3.68	x	34.53	x	0.5	x	0.8	=	35.22	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.5	x	0.8	=	48.43	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	3.68	x	55.46	x	0.5	x	0.8	=	56.58	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.5	x	0.8	=	77.8	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	3.68	x	74.72	x	0.5	x	0.8	=	76.22	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.5	x	0.8	=	104.8	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	3.68	x	79.99	x	0.5	x	0.8	=	81.59	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.5	x	0.8	=	112.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	3.68	x	74.68	x	0.5	x	0.8	=	76.18	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.5	x	0.8	=	104.74	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	3.68	x	59.25	x	0.5	x	0.8	=	60.44	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.5	x	0.8	=	83.1	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	3.68	x	41.52	x	0.5	x	0.8	=	42.35	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.5	x	0.8	=	58.23	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	3.68	x	24.19	x	0.5	x	0.8	=	24.68	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.5	x	0.8	=	33.93	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	3.68	x	13.12	x	0.5	x	0.8	=	13.38	(74)

North	0.9x	0.77	x	5.06	x	13.12	x	0.5	x	0.8	=	18.4	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	3.68	x	8.86	x	0.5	x	0.8	=	9.04	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.5	x	0.8	=	12.43	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
South	0.9x	0.77	x	3.22	x	46.75	x	0.5	x	0.8	=	41.73	(78)
South	0.9x	0.77	x	3.22	x	76.57	x	0.5	x	0.8	=	68.34	(78)
South	0.9x	0.77	x	3.22	x	97.53	x	0.5	x	0.8	=	87.06	(78)
South	0.9x	0.77	x	3.22	x	110.23	x	0.5	x	0.8	=	98.39	(78)
South	0.9x	0.77	x	3.22	x	114.87	x	0.5	x	0.8	=	102.53	(78)
South	0.9x	0.77	x	3.22	x	110.55	x	0.5	x	0.8	=	98.67	(78)
South	0.9x	0.77	x	3.22	x	108.01	x	0.5	x	0.8	=	96.41	(78)
South	0.9x	0.77	x	3.22	x	104.89	x	0.5	x	0.8	=	93.63	(78)
South	0.9x	0.77	x	3.22	x	101.89	x	0.5	x	0.8	=	90.94	(78)
South	0.9x	0.77	x	3.22	x	82.59	x	0.5	x	0.8	=	73.71	(78)
South	0.9x	0.77	x	3.22	x	55.42	x	0.5	x	0.8	=	49.46	(78)
South	0.9x	0.77	x	3.22	x	40.4	x	0.5	x	0.8	=	36.06	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	83.76	148.67	223.55	317.64	397.87	414.85	391.6	327.82	255.05	169.33	101.32	71.1	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	595.82	658.38	716.5	783.39	835.57	825.9	785.6	728.44	669.88	611.6	575.1	568.93	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.98	0.92	0.76	0.58	0.65	0.9	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.14	20.33	20.58	20.83	20.96	20.99	20.99	20.89	20.6	20.27	20.01	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.97	0.89	0.69	0.48	0.54	0.84	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.89	19.04	19.31	19.67	20.01	20.16	20.18	20.18	20.09	19.69	19.22	18.84	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.23	19.37	19.61	19.95	20.25	20.4	20.43	20.42	20.33	19.96	19.53	19.19	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.23	19.37	19.61	19.95	20.25	20.4	20.43	20.42	20.33	19.96	19.53	19.19	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.97	0.89	0.71	0.51	0.57	0.85	0.98	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	594.99	656.47	710.93	760.99	746.66	585.07	400.99	418.67	572.66	599.8	573.28	568.34	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1576.25	1527.29	1384.15	1165.89	902.64	612.34	404.03	424.78	658.09	988.39	1312.18	1582.53	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	730.06	585.19	500.87	291.53	116.05	0	0	0	0	289.11	532.01	754.56	

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	3799.38	(98)
Space heating requirement in kWh/m²/year		31.56	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		3799.38	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	2992.01	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	997.34	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2259.46	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1779.33	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	593.11	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	63.62	(313)

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Cooling System Energy Efficiency Ratio				0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =			0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside				77.9	(330a)
warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			77.9	(331)
Energy for lighting (calculated in Appendix L)				466.03	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	7873.71	x	0.22		1700.72	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	2519.59	x	0.52		-1307.67	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4682.43	x	0.22		1011.41	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1498.38	x	0.52		-777.66	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	369.39	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	33.02	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	1029.21	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					1029.21	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	40.43	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	241.87	(379)
Total CO2, kg/year	sum of (376)…(382) =					1311.52	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					10.89	(384)
EI rating (section 14)						89.37	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: a1-2-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	120.39	(1a) x	2.4	(2a) =	288.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	120.39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	288.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.39	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.31	0.33	0.35	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			3.68	x1/[1/(1.4)+ 0.04]		=	4.88			(27)
Windows Type 2			5.06	x1/[1/(1.4)+ 0.04]		=	6.71			(27)
Windows Type 3			3.22	x1/[1/(1.4)+ 0.04]		=	4.27			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 5			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Floor			120.39	x	0.13	=	15.6507			(28)
Walls Type1	32.79	17.48	15.31	x	0.18	=	2.76			(29)
Walls Type2	25.04	2.1	22.94	x	0.18	=	4.13			(29)
Total area of elements, m²			178.22							(31)
Party wall			61.8	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 47.81 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.9 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 58.71 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	56.12	55.8	55.47	53.96	53.68	52.36	52.36	52.12	52.87	53.68	54.25	54.85	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	114.83	114.5	114.18	112.67	112.39	111.07	111.07	110.83	111.58	112.39	112.96	113.56	

Average = Sum(39)$_{1...12}$ /12= 112.67 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.86 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 102.24 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	112.46	108.37	104.28	100.19	96.1	92.02	92.02	96.1	100.19	104.28	108.37	112.46	

Total = Sum(44)$_{1...12}$ = 1226.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.78	145.87	150.52	131.23	125.92	108.66	100.69	115.54	116.92	136.26	148.74	161.52	

Total = Sum(45)$_{1...12}$ = 1608.62 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.02	21.88	22.58	19.68	18.89	16.3	15.1	17.33	17.54	20.44	22.31	24.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	213.37	187.95	197.12	176.32	172.51	153.75	147.28	162.13	162.01	182.85	193.83	208.11	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	213.37	187.95	197.12	176.32	172.51	153.75	147.28	162.13	162.01	182.85	193.83	208.11

Output from water heater (annual)$_{1…12}$ | 2157.24 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.73	82.17	87.32	79.71	79.14	72.2	70.75	75.69	74.95	82.58	85.53	90.98	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	27.11	24.08	19.58	14.83	11.08	9.36	10.11	13.14	17.64	22.4	26.14	27.87	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	285.72	288.68	281.21	265.31	245.23	226.36	213.75	210.79	218.26	234.16	254.24	273.11	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	(71)

Water heating gains (Table 5)

(72)m=	124.64	122.28	117.37	110.7	106.38	100.28	95.1	101.74	104.1	111	118.79	122.29	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	506.44	504.01	487.14	459.81	431.66	404.97	387.93	394.64	408.97	436.53	468.14	492.24	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	3.68	x	10.63	x	0.63	x	0.7	=	11.96	(74)
North	0.9x	0.77	x	5.06	x	10.63	x	0.63	x	0.7	=	16.44	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	3.68	x	20.32	x	0.63	x	0.7	=	22.85	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.63	x	0.7	=	31.42	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	3.68	x	34.53	x	0.63	x	0.7	=	38.83	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.63	x	0.7	=	53.4	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	3.68	x	55.46	x	0.63	x	0.7	=	62.38	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.63	x	0.7	=	85.77	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	3.68	x	74.72	x	0.63	x	0.7	=	84.03	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.63	x	0.7	=	115.54	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	3.68	x	79.99	x	0.63	x	0.7	=	89.96	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.63	x	0.7	=	123.69	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	3.68	x	74.68	x	0.63	x	0.7	=	83.99	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.63	x	0.7	=	115.48	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	3.68	x	59.25	x	0.63	x	0.7	=	66.63	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.63	x	0.7	=	91.62	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	3.68	x	41.52	x	0.63	x	0.7	=	46.69	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.63	x	0.7	=	64.2	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	3.68	x	24.19	x	0.63	x	0.7	=	27.2	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.63	x	0.7	=	37.41	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	3.68	x	13.12	x	0.63	x	0.7	=	14.75	(74)

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North	0.9x	0.77	x	5.06	x	13.12	x	0.63	x	0.7	=	20.29	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	3.68	x	8.86	x	0.63	x	0.7	=	9.97	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.63	x	0.7	=	13.71	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
South	0.9x	0.77	x	3.22	x	46.75	x	0.63	x	0.7	=	46.01	(78)
South	0.9x	0.77	x	3.22	x	76.57	x	0.63	x	0.7	=	75.35	(78)
South	0.9x	0.77	x	3.22	x	97.53	x	0.63	x	0.7	=	95.98	(78)
South	0.9x	0.77	x	3.22	x	110.23	x	0.63	x	0.7	=	108.48	(78)
South	0.9x	0.77	x	3.22	x	114.87	x	0.63	x	0.7	=	113.04	(78)
South	0.9x	0.77	x	3.22	x	110.55	x	0.63	x	0.7	=	108.79	(78)
South	0.9x	0.77	x	3.22	x	108.01	x	0.63	x	0.7	=	106.29	(78)
South	0.9x	0.77	x	3.22	x	104.89	x	0.63	x	0.7	=	103.22	(78)
South	0.9x	0.77	x	3.22	x	101.89	x	0.63	x	0.7	=	100.26	(78)
South	0.9x	0.77	x	3.22	x	82.59	x	0.63	x	0.7	=	81.27	(78)
South	0.9x	0.77	x	3.22	x	55.42	x	0.63	x	0.7	=	54.53	(78)
South	0.9x	0.77	x	3.22	x	40.4	x	0.63	x	0.7	=	39.75	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	92.35	163.91	246.46	350.2	438.66	457.37	431.74	361.42	281.19	186.69	111.7	78.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	598.79	667.92	733.61	810.01	870.32	862.33	819.67	756.06	690.16	623.22	579.85	570.62	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.98	0.92	0.76	0.59	0.65	0.9	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.05	20.25	20.54	20.8	20.96	20.99	20.99	20.88	20.55	20.2	19.92	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.12	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.97	0.89	0.68	0.48	0.54	0.85	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.68	18.85	19.15	19.57	19.93	20.12	20.15	20.14	20.04	19.59	19.07	18.66	(90)

fLA = Living area ÷ (4) = | 0.3 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.05	19.21	19.48	19.86	20.19	20.37	20.4	20.4	20.29	19.88	19.41	19.04	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.05	19.21	19.48	19.86	20.19	20.37	20.4	20.4	20.29	19.88	19.41	19.04	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.97	0.89	0.71	0.51	0.58	0.86	0.98	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	597.91	665.87	727.63	786.02	776.95	609.34	418.22	435.47	591.72	611.23	577.96	569.99	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1694.26	1638.27	1481.74	1234.88	954.6	640.84	422.03	442.95	690.68	1042.99	1390.49	1684.83	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	815.68	653.45	561.06	323.18	132.17	0	0	0	0	321.23	585.02	829.43	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4221.23 (98)

Space heating requirement in kWh/m²/year 35.06 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	815.68	653.45	561.06	323.18	132.17	0	0	0	0	321.23	585.02	829.43		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	872.39	698.88	600.07	345.64	141.36	0	0	0	0	343.56	625.69	887.1		
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													4514.69	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	213.37	187.95	197.12	176.32	172.51	153.75	147.28	162.13	162.01	182.85	193.83	208.11		
Efficiency of water heater													79.8	(216)
(217)m=	88.05	87.87	87.45	86.41	84.11	79.8	79.8	79.8	79.8	86.3	87.58	88.13		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	242.33	213.9	225.4	204.05	205.09	192.67	184.56	203.17	203.02	211.87	221.32	236.14		
Total = Sum(219a)$_{1...12}$ =													2543.53	(219)

Annual totals **kWh/year** **kWh/year**

Space heating fuel used, main system 1 4514.69

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Water heating fuel used			2543.53	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			478.82	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	975.17	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	549.4	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1524.58	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	248.51	(268)
Total CO2, kg/year		sum of (265)…(271) =		1812.01	(272)

TER = 15.05 (273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-3-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.94	(1a) x	2.4	(2a) =	179.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.94	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	179.86	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.98	x1/[1/(1.2)+ 0.04]		=	6.85			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	41.4	14.26	27.14	x	0.18	=	4.89			(29)
Walls Type2	10.58	2.1	8.48	x	0.18	=	1.53			(29)
Total area of elements, m²			51.98							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.26 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.17 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 34.43 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.1	64.1	64.1	64.1	64.1	64.1	64.1	64.1	64.1	64.1	64.1	64.1	

Average = Sum(39)$_{1\ldots12}$ /12= 64.1 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	

Average = Sum(40)$_{1...12}$ /12= 0.86 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.36 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	99.27	95.66	92.05	88.44	84.83	81.22	81.22	84.83	88.44	92.05	95.66	99.27	

Total = Sum(44)$_{1...12}$ = 1082.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	147.22	128.76	132.87	115.83	111.15	95.91	88.88	101.99	103.2	120.27	131.29	142.57	

Total = Sum(45)$_{1...12}$ = 1419.93 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	22.08	19.31	19.93	17.38	16.67	14.39	13.33	15.3	15.48	18.04	19.69	21.39	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.49	178.68	188.14	169.33	166.42	149.4	144.15	157.26	156.7	175.55	184.78	197.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.49	178.68	188.14	169.33	166.42	149.4	144.15	157.26	156.7	175.55	184.78	197.85

Output from water heater (annual)$_{1...12}$ 2070.77 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.17	82.75	88.4	81.31	81.18	74.69	73.77	78.13	77.11	84.21	86.45	91.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.61	16.53	13.44	10.17	7.61	6.42	6.94	9.02	12.1	15.37	17.94	19.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	208.54	210.71	205.25	193.64	178.99	165.22	156.01	153.85	159.3	170.91	185.57	199.34	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	(71)

Water heating gains (Table 5)

(72)m=	125.23	123.15	118.82	112.93	109.11	103.73	99.16	105.02	107.1	113.19	120.07	123.15	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	410.78	408.77	395.91	375.15	354.1	333.76	320.51	326.28	336.9	357.87	381.97	400.02	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.98	x	10.63	x	0.5	x	0.8	=	17.63	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	5.98	x	20.32	x	0.5	x	0.8	=	33.69	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)

North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.98	x	34.53	x	0.5	x	0.8	=	57.24	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.98	x	55.46	x	0.5	x	0.8	=	91.94	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.98	x	74.72	x	0.5	x	0.8	=	123.85	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.98	x	79.99	x	0.5	x	0.8	=	132.59	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.98	x	74.68	x	0.5	x	0.8	=	123.79	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.98	x	59.25	x	0.5	x	0.8	=	98.21	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.98	x	41.52	x	0.5	x	0.8	=	68.82	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.98	x	24.19	x	0.5	x	0.8	=	40.1	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.98	x	13.12	x	0.5	x	0.8	=	21.74	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.98	x	8.86	x	0.5	x	0.8	=	14.69	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)

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East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	48.92	94.17	158.48	247.41	324.7	343.55	322.38	261.3	188.65	111.99	60.55	40.62	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	459.7	502.95	554.39	622.56	678.8	677.31	642.89	587.58	525.55	469.86	442.52	440.63	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.8	0.6	0.44	0.5	0.78	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.19	20.3	20.49	20.75	20.93	20.99	21	21	20.96	20.72	20.4	20.16	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.75	0.53	0.36	0.41	0.71	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.12	19.27	19.56	19.91	20.14	20.2	20.21	20.2	20.17	19.88	19.43	19.07	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.55	19.68	19.93	20.25	20.46	20.52	20.52	20.52	20.49	20.21	19.82	19.5	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.55	19.68	19.93	20.25	20.46	20.52	20.52	20.52	20.49	20.21	19.82	19.5	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.92	0.77	0.55	0.39	0.45	0.74	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	457.76	498.85	542.18	574.22	523.37	375.15	251.08	263.35	387.76	447.23	438.46	439.19	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	977.3	947.52	860.91	727.35	561.42	379.26	251.46	264.22	409.4	616.31	815.24	980.99	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	386.54	301.51	237.13	110.25	28.31	0	0	0	0	125.8	271.28	403.09	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1863.91 | (98)

Space heating requirement in kWh/m²/year | 24.87 | (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1863.91	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1467.83	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	489.28	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		2070.77	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1630.73	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	543.58	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	41.31	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		48.49	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	48.49	(331)
Energy for lighting (calculated in Appendix L)		328.59	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		**Emission factor kg CO2/kWh**	**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	3862.71	x	0.22	834.35	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1236.07	x	0.52	-641.52	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4291.4	x	0.22	926.94	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1373.25	x	0.52	-712.72	(366)

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Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	239.89	(368)
Electrical energy for heat distribution	[(313) x	0.52	=	21.44	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	668.38	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			668.38	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	25.17	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	170.54	(379)
Total CO2, kg/year	sum of (376)…(382) =			864.09	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			11.53	(384)
EI rating (section 14)				90.35	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**

Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-3-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.94	(1a) x	2.4	(2a) =	179.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.94	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	179.86	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.98	x1/[1/(1.4)+ 0.04]		=	7.93			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	41.4	14.26	27.14	x	0.18	=	4.89			(29)
Walls Type2	10.58	2.1	8.48	x	0.18	=	1.53			(29)
Total area of elements, m²			51.98							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	27.42	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		4.73	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	32.14	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.73	35.5	35.27	34.18	33.98	33.04	33.04	32.86	33.4	33.98	34.39	34.82	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	67.87	67.64	67.41	66.33	66.12	65.18	65.18	65.01	65.54	66.12	66.53	66.96	

Average = Sum(39)$_{1...12}$ /12= 66.33 (39)

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Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	0.91	0.9	0.9	0.89	0.88	0.87	0.87	0.87	0.87	0.88	0.89	0.89

Average = Sum(40)$_{1…12}$ /12= 0.89 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.36 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 90.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	99.27	95.66	92.05	88.44	84.83	81.22	81.22	84.83	88.44	92.05	95.66	99.27	
Total = Sum(44)$_{1…12}$ =												1082.96	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	147.22	128.76	132.87	115.83	111.15	95.91	88.88	101.99	103.2	120.27	131.29	142.57	
Total = Sum(45)$_{1…12}$ =												1419.93	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	22.08	19.31	19.93	17.38	16.67	14.39	13.33	15.3	15.48	18.04	19.69	21.39	(46)

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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.39 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = — 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = — 0 (54)

Enter (50) or (54) in (55) — 0.75 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	193.81	170.84	179.46	160.93	157.74	141	135.47	148.58	148.3	166.87	176.38	189.17	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	193.81	170.84	179.46	160.93	157.74	141	135.47	148.58	148.3	166.87	176.38	189.17	

Output from water heater (annual)$_{1...12}$ 1968.55 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.23	76.48	81.45	74.59	74.23	67.96	66.83	71.19	70.39	77.27	79.73	84.68	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.83	16.73	13.6	10.3	7.7	6.5	7.02	9.13	12.25	15.56	18.16	19.36	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	208.54	210.71	205.25	193.64	178.99	165.22	156.01	153.85	159.3	170.91	185.57	199.34	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	(71)

Water heating gains (Table 5)

(72)m=	115.89	113.81	109.48	103.6	99.77	94.39	89.82	95.68	97.76	103.85	110.73	113.82	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	404.67	402.64	389.74	368.94	347.86	327.51	314.26	320.06	330.72	351.72	375.86	393.91	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.98	x	10.63	x	0.63	x	0.7	=	19.43	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	5.98	x	20.32	x	0.63	x	0.7	=	37.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)

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North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	5.98	x	34.53	x	0.63	x	0.7	=	63.11	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	5.98	x	55.46	x	0.63	x	0.7	=	101.36	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	5.98	x	74.72	x	0.63	x	0.7	=	136.55	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	5.98	x	79.99	x	0.63	x	0.7	=	146.18	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	5.98	x	74.68	x	0.63	x	0.7	=	136.48	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	5.98	x	59.25	x	0.63	x	0.7	=	108.28	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	5.98	x	41.52	x	0.63	x	0.7	=	75.87	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	5.98	x	24.19	x	0.63	x	0.7	=	44.21	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	5.98	x	13.12	x	0.63	x	0.7	=	23.97	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	5.98	x	8.86	x	0.63	x	0.7	=	16.2	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)

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East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	53.94	103.83	174.73	272.77	357.98	378.76	355.42	288.08	207.98	123.47	66.76	44.78	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	458.61	506.47	564.46	641.71	705.84	706.27	669.68	608.14	538.7	475.19	442.61	438.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.94	0.8	0.58	0.43	0.49	0.78	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.23	20.45	20.74	20.93	20.99	21	21	20.96	20.7	20.36	20.1	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.17	20.17	20.18	20.18	20.19	20.19	20.2	20.19	20.18	20.18	20.17	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.75	0.51	0.35	0.4	0.71	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.15	19.46	19.87	20.12	20.19	20.19	20.19	20.16	19.83	19.35	18.96	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.43	19.58	19.85	20.22	20.44	20.51	20.52	20.52	20.48	20.18	19.75	19.41	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.43	19.58	19.85	20.22	20.44	20.51	20.52	20.52	20.48	20.18	19.75	19.41	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.92	0.76	0.54	0.38	0.44	0.73	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	456.76	502.43	552.08	590.04	538.78	381.36	254.85	266.72	395.39	452.68	438.72	437.32	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1026.87	993.06	900.24	750.73	578.09	385.19	255.21	267.55	417.87	633.46	841.88	1018.66	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	424.17	329.7	259.03	115.7	29.24	0	0	0	0	134.5	290.28	432.52	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = | 2015.14 | (98)

Space heating requirement in kWh/m²/year | 26.89 | (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system | 0 | (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =		1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =		1	(204)
Efficiency of main space heating system 1			93.5	(206)
Efficiency of secondary/supplementary heating system, %			0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	424.17	329.7	259.03	115.7	29.24	0	0	0	0	134.5	290.28	432.52		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	453.65	352.62	277.04	123.74	31.28	0	0	0	0	143.85	310.46	462.58		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2155.23	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	193.81	170.84	179.46	160.93	157.74	141	135.47	148.58	148.3	166.87	176.38	189.17		
Efficiency of water heater													79.8	(216)
(217)m=	86.85	86.54	85.79	83.95	81.3	79.8	79.8	79.8	79.8	84.25	86.13	86.95		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	223.16	197.42	209.18	191.69	194.02	176.7	169.76	186.19	185.83	198.08	204.77	217.55		
Total = Sum(219a)$_{1...12}$ =													2354.35	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2155.23	
Water heating fuel used			2354.35	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			332.62	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	465.53	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	508.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =			974.07	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	172.63	(268)

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Total CO2, kg/year	sum of (265)…(271) =	1185.62	(272)
TER =		15.82	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: a1-3-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.81	(1a) x	2.4	(2a) =	129.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.81	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	129.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then		(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			6.44	x1/[1/(1.2)+ 0.04]		=	7.37			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	19.19	9.2	9.99	x	0.18	=	1.8			(29)
Walls Type2	16.19	2.1	14.09	x	0.18	=	2.54			(29)
Total area of elements, m²			35.38							(31)
Party wall			35.3	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 17.39 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.62 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 24.01 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	21.31	21.31	21.31	21.31	21.31	21.31	21.31	21.31	21.31	21.31	21.31	21.31	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	45.32	45.32	45.32	45.32	45.32	45.32	45.32	45.32	45.32	45.32	45.32	45.32	

Average = Sum(39)$_{1…12}$ /12= 45.32 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84

Average = Sum(40)$_{1…12}$ /12= 0.84 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.8 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	84.71	81.63	78.55	75.47	72.39	69.31	69.31	72.39	75.47	78.55	81.63	84.71	
										Total = Sum(44)$_{1…12}$ =		924.09	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	125.62	109.87	113.37	98.84	94.84	81.84	75.84	87.02	88.06	102.63	112.03	121.66	
										Total = Sum(45)$_{1…12}$ =		1211.63	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.84	16.48	17.01	14.83	14.23	12.28	11.38	13.05	13.21	15.39	16.8	18.25	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	180.9	159.8	168.65	152.34	150.12	135.33	131.11	142.3	141.56	157.91	165.52	176.93	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	180.9	159.8	168.65	152.34	150.12	135.33	131.11	142.3	141.56	157.91	165.52	176.93	

Output from water heater (annual)$_{1...12}$ 1862.47 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.99	76.47	81.92	75.66	75.76	70.01	69.44	73.16	72.08	78.35	80.04	84.67	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	14.14	12.56	10.22	7.73	5.78	4.88	5.27	6.85	9.2	11.68	13.63	14.54	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	157.11	158.74	154.64	145.89	134.85	124.47	117.54	115.91	120.02	128.76	139.8	150.18	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	(71)
Water heating gains (Table 5)													
(72)m=	115.58	113.8	110.11	105.08	101.82	97.23	93.33	98.33	100.11	105.3	111.17	113.81	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	336.87	335.14	324.99	308.74	292.49	276.62	266.18	271.13	279.36	295.79	314.65	328.56	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	6.44	x	19.64	x	0.5	x	0.8	=	35.06	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	6.44	x	38.42	x	0.5	x	0.8	=	68.59	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	6.44	x	63.27	x	0.5	x	0.8	=	112.95	(76)

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East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	6.44	x	92.28	x	0.5	x	0.8	=	164.74	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	6.44	x	113.09	x	0.5	x	0.8	=	201.89	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	6.44	x	115.77	x	0.5	x	0.8	=	206.67	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	6.44	x	110.22	x	0.5	x	0.8	=	196.76	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	6.44	x	94.68	x	0.5	x	0.8	=	169.01	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	6.44	x	73.59	x	0.5	x	0.8	=	131.37	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	6.44	x	45.59	x	0.5	x	0.8	=	81.38	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	6.44	x	24.49	x	0.5	x	0.8	=	43.72	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	6.44	x	16.15	x	0.5	x	0.8	=	28.83	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	50.09	97.98	161.36	235.34	288.41	295.24	281.08	241.45	187.67	116.26	62.45	41.19	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.96	433.12	486.35	544.08	580.9	571.86	547.26	512.58	467.03	412.05	377.1	369.75	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.87	0.7	0.5	0.36	0.41	0.65	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.31	20.44	20.65	20.86	20.97	21	21	21	20.99	20.83	20.52	20.27	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.84	0.65	0.44	0.3	0.34	0.59	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.3	19.49	19.78	20.07	20.19	20.21	20.22	20.22	20.21	20.03	19.61	19.25	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.81	19.96	20.21	20.46	20.58	20.61	20.61	20.61	20.6	20.43	20.07	19.76	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.81	19.96	20.21	20.46	20.58	20.61	20.61	20.61	20.6	20.43	20.07	19.76	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.85	0.67	0.47	0.33	0.37	0.62	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	383.31	424.61	460.79	462.36	390.3	271.02	181.55	190.51	288.78	369.96	369.25	367.08	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	702.76	682.7	621.51	524.03	402.47	272.18	181.65	190.7	294.38	445.41	587.56	705.13	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	237.67	173.44	119.58	44.4	9.05	0	0	0	0	56.13	157.19	251.51	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1048.97 (98)

Space heating requirement in kWh/m²/year 19.49 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1048.97	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	826.07	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	275.36	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1862.47	
If DHW from community scheme:			
Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1466.69	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	488.9	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	30.57	(313)

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Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		34.82	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	34.82	(331)
Energy for lighting (calculated in Appendix L)		249.76	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	2173.86	x	0.22		469.55	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	695.64	x	0.52		-361.03	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	3859.71	x	0.22		833.7	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1235.11	x	0.52		-641.02	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	177.5	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	15.87	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	494.57	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					494.57	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	18.07	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	129.62	(379)
Total CO2, kg/year	sum of (376)…(382) =					642.26	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					11.94	(384)
EI rating (section 14)						91.29	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-3-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.81	(1a) x	2.4	(2a) =	129.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.81	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	129.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			6.44	x1/[1/(1.4)+ 0.04]		=	8.54			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	19.19	9.2	9.99	x	0.18	=	1.8			(29)
Walls Type2	16.19	2.1	14.09	x	0.18	=	2.54			(29)
Total area of elements, m²			35.38							(31)
Party wall			35.3	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	18.63	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		3.07	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	21.7	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.41	25.25	25.1	24.36	24.23	23.59	23.59	23.47	23.83	24.23	24.5	24.79	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.11	46.95	46.8	46.06	45.93	45.29	45.29	45.17	45.53	45.93	46.2	46.49

Average = Sum(39)$_{1…12}$ /12= 46.06 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.88	0.87	0.87	0.86	0.85	0.84	0.84	0.84	0.85	0.85	0.86	0.86

Average = $Sum(40)_{1...12}$ /12= 0.86 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.8 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	84.71	81.63	78.55	75.47	72.39	69.31	69.31	72.39	75.47	78.55	81.63	84.71	
										Total = $Sum(44)_{1...12}$ =		924.09	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	125.62	109.87	113.37	98.84	94.84	81.84	75.84	87.02	88.06	102.63	112.03	121.66	
										Total = $Sum(45)_{1...12}$ =		1211.63	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.84	16.48	17.01	14.83	14.23	12.28	11.38	13.05	13.21	15.39	16.8	18.25	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	172.21	151.95	159.97	143.93	141.44	126.93	122.43	133.62	133.16	149.22	157.12	168.25	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	172.21	151.95	159.97	143.93	141.44	126.93	122.43	133.62	133.16	149.22	157.12	168.25	

Output from water heater (annual)$_{1...12}$ 1760.24 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	79.04	70.2	74.97	68.94	68.81	63.29	62.49	66.21	65.35	71.4	73.32	77.73	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.43	12.82	10.42	7.89	5.9	4.98	5.38	6.99	9.39	11.92	13.91	14.83	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	157.11	158.74	154.64	145.89	134.85	124.47	117.54	115.91	120.02	128.76	139.8	150.18	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	(71)

Water heating gains (Table 5)

(72)m=	106.24	104.46	100.77	95.75	92.49	87.9	83.99	88.99	90.77	95.97	101.84	104.47	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	330.82	329.06	318.87	302.57	286.27	270.39	259.95	264.93	273.21	289.69	308.59	322.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	6.44	x	19.64	x	0.63	x	0.7	=	38.65	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	6.44	x	38.42	x	0.63	x	0.7	=	75.62	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	6.44	x	63.27	x	0.63	x	0.7	=	124.53	(76)

East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	6.44	x	92.28	x	0.63	x	0.7	=	181.62	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	6.44	x	113.09	x	0.63	x	0.7	=	222.58	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	6.44	x	115.77	x	0.63	x	0.7	=	227.85	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	6.44	x	110.22	x	0.63	x	0.7	=	216.93	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	6.44	x	94.68	x	0.63	x	0.7	=	186.34	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	6.44	x	73.59	x	0.63	x	0.7	=	144.83	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	6.44	x	45.59	x	0.63	x	0.7	=	89.73	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	6.44	x	24.49	x	0.63	x	0.7	=	48.2	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	6.44	x	16.15	x	0.63	x	0.7	=	31.79	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	55.22	108.02	177.9	259.46	317.98	325.5	309.89	266.19	206.91	128.18	68.85	45.41	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.05	437.09	496.77	562.02	604.25	595.89	569.85	531.13	480.12	417.87	377.45	367.93	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.86	0.68	0.48	0.35	0.39	0.64	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.26	20.4	20.63	20.86	20.97	21	21	21	20.99	20.82	20.5	20.24	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.19	20.19	20.19	20.21	20.21	20.22	20.22	20.22	20.21	20.21	20.2	20.2	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.83	0.63	0.43	0.29	0.32	0.57	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.21	19.41	19.73	20.06	20.18	20.22	20.22	20.22	20.2	20.02	19.57	19.18	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.73	19.91	20.18	20.46	20.58	20.61	20.61	20.61	20.6	20.42	20.04	19.71	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.73	19.91	20.18	20.46	20.58	20.61	20.61	20.61	20.6	20.42	20.04	19.71	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.98	0.95	0.84	0.66	0.45	0.32	0.36	0.61	0.9	0.98	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	382.63	428.66	470.25	472.46	396.56	271.13	181.47	189.98	290.68	374.41	369.82	365.41		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	727.07	704.7	640.24	532.58	407.76	272.03	181.54	190.14	295.76	451.05	597.66	721.02		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	256.26	185.5	126.47	43.28	8.33	0	0	0	0	57.02	164.05	264.57		
Total per year (kWh/year) = Sum(98)1...5,9...12 =													1105.48	(98)
Space heating requirement in kWh/m²/year													20.54	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	256.26	185.5	126.47	43.28	8.33	0	0	0	0	57.02	164.05	264.57		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	274.08	198.4	135.26	46.29	8.91	0	0	0	0	60.98	175.45	282.96		
Total (kWh/year) =Sum(211)1...5,10...12=													1182.33	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)1...5,10...12=													0	(215)
Water heating														
Output from water heater (calculated above)														
	172.21	151.95	159.97	143.93	141.44	126.93	122.43	133.62	133.16	149.22	157.12	168.25		
Efficiency of water heater													79.8	(216)
(217)m=	85.87	85.35	84.2	82.04	80.33	79.8	79.8	79.8	79.8	82.5	84.93	86.02		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	200.55	178.04	190	175.44	176.07	159.06	153.42	167.44	166.86	180.89	185	195.6		
Total = Sum(219a)1...12 =													2128.38	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1182.33

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Water heating fuel used			2128.38	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			254.86	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	255.38	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	459.73	(264)
Space and water heating	(261) + (262) + (263) + (264) =			715.11	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	132.27	(268)
Total CO2, kg/year		sum of (265)…(271) =		886.31	(272)
TER =				16.47	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-3-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.35	(1a) x	2.4	(2a) =	176.04	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.35	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.04	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.06	x1/[1/(1.2)+ 0.04]		=	5.79			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	41.75	10.58	31.17	x	0.18	=	5.61			(29)
Walls Type2	13.03	2.1	10.93	x	0.18	=	1.97			(29)
Total area of elements, m²			54.78							(31)
Party wall			28.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 22.21 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.43 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 30.64 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.05	29.05	29.05	29.05	29.05	29.05	29.05	29.05	29.05	29.05	29.05	29.05	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	59.69	59.69	59.69	59.69	59.69	59.69	59.69	59.69	59.69	59.69	59.69	59.69	

Average = Sum(39)1…12 /12= 59.69 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81

Average = Sum(40)$_{1...12}$ /12= 0.81 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.32 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.41 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.35	94.77	91.2	87.62	84.05	80.47	80.47	84.05	87.62	91.2	94.77	98.35	
Total = Sum(44)$_{1...12}$ =												1072.92	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	145.85	127.56	131.63	114.76	110.12	95.02	88.05	101.04	102.25	119.16	130.07	141.25	
Total = Sum(45)$_{1...12}$ =												1406.77	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	21.88	19.13	19.75	17.21	16.52	14.25	13.21	15.16	15.34	17.87	19.51	21.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.13	177.49	186.91	168.25	165.39	148.52	143.33	156.32	155.74	174.44	183.57	196.53	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.13	177.49	186.91	168.25	165.39	148.52	143.33	156.32	155.74	174.44	183.57	196.53	

Output from water heater (annual)$_{1...12}$ 2057.61 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.72	82.36	87.99	80.95	80.84	74.39	73.5	77.82	76.79	83.84	86.04	91.19	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.96	16.84	13.69	10.37	7.75	6.54	7.07	9.19	12.33	15.66	18.28	19.48	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	204.99	207.11	201.75	190.34	175.94	162.4	153.35	151.23	156.59	168	182.4	195.94	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	(71)

Water heating gains (Table 5)

(72)m=	124.62	122.55	118.27	112.43	108.65	103.32	98.79	104.59	106.66	112.69	119.51	122.56	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	406.43	404.37	391.58	371.01	350.2	330.13	317.08	322.88	333.44	354.22	378.05	395.86	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.06	x	19.64	x	0.5	x	0.8	=	27.55	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	5.06	x	38.42	x	0.5	x	0.8	=	53.89	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	5.06	x	63.27	x	0.5	x	0.8	=	88.75	(76)

East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	5.06	x	92.28	x	0.5	x	0.8	=	129.44	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	5.06	x	113.09	x	0.5	x	0.8	=	158.63	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	5.06	x	115.77	x	0.5	x	0.8	=	162.38	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	5.06	x	110.22	x	0.5	x	0.8	=	154.6	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	5.06	x	94.68	x	0.5	x	0.8	=	132.8	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	5.06	x	73.59	x	0.5	x	0.8	=	103.22	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	5.06	x	45.59	x	0.5	x	0.8	=	63.94	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	5.06	x	24.49	x	0.5	x	0.8	=	34.35	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	5.06	x	16.15	x	0.5	x	0.8	=	22.65	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	78.34	141.86	211.78	284.37	333.04	335.53	321.56	285.48	237.47	162.01	95.48	65.92	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	484.77	546.24	603.36	655.39	683.24	665.66	638.64	608.36	570.91	516.22	473.54	461.78	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.91	0.76	0.57	0.41	0.45	0.7	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.3	20.43	20.62	20.83	20.96	20.99	21	21	20.98	20.81	20.51	20.26	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.88	0.72	0.5	0.34	0.38	0.63	0.91	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.3	19.49	19.76	20.05	20.2	20.24	20.24	20.24	20.23	20.03	19.61	19.25	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.7	19.86	20.11	20.36	20.5	20.54	20.54	20.54	20.53	20.34	19.97	19.65	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.7	19.86	20.11	20.36	20.5	20.54	20.54	20.54	20.53	20.34	19.97	19.65	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.96	0.89	0.73	0.53	0.37	0.41	0.66	0.92	0.98	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	481.58	538.14	579.69	581.81	501.28	352.12	235.26	247.01	374.48	472.69	466.21	459.51	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	919.34	893.22	812.11	683.95	525.43	354.59	235.45	247.37	383.74	581.63	768.06	922.37	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	325.69	238.61	172.92	73.54	17.97	0	0	0	0	81.05	217.33	344.37	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1471.49 (98)

Space heating requirement in kWh/m²/year 20.06 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating	**kWh/year**
Annual space heating requirement	1471.49

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Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1158.8	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	386.27	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2057.61	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1620.37	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	540.12	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	37.06	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.46	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	47.46	(331)
Energy for lighting (calculated in Appendix L)		334.76	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	3049.47	x	0.22		658.68	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	975.83	x	0.52		-506.46	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4264.12	x	0.22		921.05	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1364.52	x	0.52		-708.19	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	215.16	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	19.23	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	599.49	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					599.49	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	24.63	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	173.74	(379)
Total CO2, kg/year	sum of (376)…(382) =					797.86	(383)

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Dwelling CO2 Emission Rate	(383) ÷ (4) =	10.88	(384)
EI rating (section 14)		90.97	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.8

Property Address: a1-3-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.35	(1a) x	2.4	(2a) =	176.04	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.35	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.04	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

TER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.06	x1/[1/(1.4)+ 0.04]		=	6.71			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	41.75	10.58	31.17	x	0.18	=	5.61			(29)
Walls Type2	13.03	2.1	10.93	x	0.18	=	1.97			(29)
Total area of elements, m²			54.78							(31)
Party wall			28.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 23.7 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.39 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 28.1 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.08	34.84	34.61	33.53	33.33	32.39	32.39	32.22	32.76	33.33	33.74	34.17	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	63.17	62.94	62.71	61.63	61.43	60.49	60.49	60.32	60.85	61.43	61.84	62.26	

Average = Sum(39)$_{1…12}$ /12= 61.63 (39)

TER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(40)m=	0.86	0.86	0.85	0.84	0.84	0.82	0.82	0.82	0.83	0.84	0.84	0.85

Average = Sum(40)$_{1…12}$ /12= 0.84 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.32 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.41 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	98.35	94.77	91.2	87.62	84.05	80.47	80.47	84.05	87.62	91.2	94.77	98.35

Total = Sum(44)$_{1…12}$ = 1072.92 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(45)m=	145.85	127.56	131.63	114.76	110.12	95.02	88.05	101.04	102.25	119.16	130.07	141.25

Total = Sum(45)$_{1…12}$ = 1406.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	21.88	19.13	19.75	17.21	16.52	14.25	13.21	15.16	15.34	17.87	19.51	21.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	192.45	169.65	178.23	159.85	156.71	140.11	134.65	147.64	147.34	165.75	175.16	187.84	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	192.45	169.65	178.23	159.85	156.71	140.11	134.65	147.64	147.34	165.75	175.16	187.84

Output from water heater (annual)$_{1...12}$ 1955.39 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.77	76.08	81.04	74.23	73.89	67.67	66.55	70.87	70.07	76.9	79.32	84.24	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	116.23	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	19.48	17.3	14.07	10.65	7.96	6.72	7.26	9.44	12.67	16.09	18.78	20.02	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	204.99	207.11	201.75	190.34	175.94	162.4	153.35	151.23	156.59	168	182.4	195.94	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	-92.99	(71)
Water heating gains (Table 5)													
(72)m=	115.28	113.22	108.93	103.1	99.31	93.98	89.45	95.26	97.32	103.36	110.17	113.23	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	400.62	398.5	385.62	364.96	344.08	323.97	310.94	316.8	327.45	348.31	372.22	390.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.06	x	19.64	x	0.63	x	0.7	=	30.37	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	5.06	x	38.42	x	0.63	x	0.7	=	59.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	5.06	x	63.27	x	0.63	x	0.7	=	97.85	(76)

East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	5.06	x	92.28	x	0.63	x	0.7	=	142.7	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	5.06	x	113.09	x	0.63	x	0.7	=	174.89	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	5.06	x	115.77	x	0.63	x	0.7	=	179.03	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	5.06	x	110.22	x	0.63	x	0.7	=	170.44	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	5.06	x	94.68	x	0.63	x	0.7	=	146.41	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	5.06	x	73.59	x	0.63	x	0.7	=	113.8	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	5.06	x	45.59	x	0.63	x	0.7	=	70.5	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	5.06	x	24.49	x	0.63	x	0.7	=	37.87	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	5.06	x	16.15	x	0.63	x	0.7	=	24.98	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.37	156.41	233.49	313.52	367.17	369.93	354.52	314.74	261.81	178.61	105.27	72.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	486.99	554.91	619.11	678.48	711.26	693.9	665.46	631.54	589.26	526.93	477.49	462.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.76	0.55	0.4	0.44	0.69	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.37	20.58	20.82	20.95	21	21	21	20.98	20.8	20.48	20.21	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.2	20.2	20.21	20.22	20.22	20.23	20.23	20.23	20.23	20.22	20.22	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.99	0.99	0.96	0.88	0.71	0.49	0.33	0.37	0.62	0.91	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	19.17	19.38	19.68	20.02	20.18	20.23	20.23	20.23	20.21	20	19.54	19.15	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	19.59	19.78	20.04	20.34	20.49	20.54	20.54	20.54	20.52	20.32	19.91	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	19.59	19.78	20.04	20.34	20.49	20.54	20.54	20.54	20.52	20.32	19.91	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.96	0.88	0.72	0.51	0.36	0.39	0.65	0.91	0.98	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	483.91	546.78	594.68	598.99	515.33	356.8	238.09	249.38	381.49	482.05	470.25	460.53	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	966.21	936.37	849.3	704.95	539.95	359.03	238.26	249.7	390.71	597.15	792.42	957.11	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	358.83	261.81	189.43	76.29	18.31	0	0	0	0	85.64	231.97	369.46	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1591.74 (98)

Space heating requirement in kWh/m²/year 21.7 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	358.83	261.81	189.43	76.29	18.31	0	0	0	0	85.64	231.97	369.46	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	383.77	280.01	202.6	81.6	19.59	0	0	0	0	91.59	248.09	395.14	(211)

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1702.39 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

192.45	169.65	178.23	159.85	156.71	140.11	134.65	147.64	147.34	165.75	175.16	187.84

Efficiency of water heater 79.8 (216)

(217)m=	86.45	85.97	84.98	82.97	80.8	79.8	79.8	79.8	79.8	83.15	85.56	86.59	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	222.6	197.34	209.74	192.67	193.95	175.58	168.73	185.01	184.64	199.35	204.72	216.94

Total = Sum(219a)$_{1...12}$ = 2351.26 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1702.39	
Water heating fuel used			2351.26	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			344.01	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	367.72	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	507.87	(264)
Space and water heating	(261) + (262) + (263) + (264) =				875.59	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	178.54	(268)
Total CO2, kg/year			sum of (265)…(271) =		1093.05	(272)

TER = 14.9 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-3-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	72.42	(1a) x	2.4	(2a) =	173.81	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.42	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	173.81	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.98		x1/[1/(1.2)+ 0.04]	=	6.85			(27)
Windows Type 2			2.76		x1/[1/(1.2)+ 0.04]	=	3.16			(27)
Windows Type 3			2.76		x1/[1/(1.2)+ 0.04]	=	3.16			(27)
Windows Type 4			1.84		x1/[1/(1.2)+ 0.04]	=	2.11			(27)
Windows Type 5			2.76		x1/[1/(1.2)+ 0.04]	=	3.16			(27)
Walls Type1	46.63	16.1	30.53	x	0.18	=	5.5			(29)
Walls Type2	26.01	2.1	23.91	x	0.18	=	4.3			(29)
Total area of elements, m²			72.64							(31)
Party wall			20.62	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	30.75	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		10.55	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	41.3	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	69.98	69.98	69.98	69.98	69.98	69.98	69.98	69.98	69.98	69.98	69.98	69.98	

Average = Sum(39)$_{1...12}$ /12= 69.98 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	

Average = Sum(40)$_{1...12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.3 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.91 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.8	94.24	90.68	87.13	83.57	80.02	80.02	83.57	87.13	90.68	94.24	97.8	

Total = Sum(44)$_{1...12}$ = 1066.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.03	126.84	130.89	114.11	109.5	94.49	87.56	100.47	101.67	118.49	129.34	140.45	

Total = Sum(45)$_{1...12}$ = 1398.84 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.75	19.03	19.63	17.12	16.42	14.17	13.13	15.07	15.25	17.77	19.4	21.07	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	200.31	176.77	186.17	167.61	164.77	147.98	142.83	155.75	155.16	173.76	182.83	195.73	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	200.31	176.77	186.17	167.61	164.77	147.98	142.83	155.75	155.16	173.76	182.83	195.73

Output from water heater (annual)$_{1...12}$ | 2049.68 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.44	82.12	87.74	80.74	80.63	74.21	73.33	77.63	76.6	83.62	85.8	90.92	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.09	16.06	13.06	9.89	7.39	6.24	6.74	8.77	11.77	14.94	17.44	18.59	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	202.88	204.98	199.68	188.38	174.13	160.73	151.78	149.67	154.98	166.27	180.53	193.93	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	(71)

Water heating gains (Table 5)

(72)m=	124.25	122.2	117.93	112.14	108.37	103.07	98.57	104.34	106.39	112.39	119.17	122.21	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	402.77	400.8	388.23	367.96	347.44	327.59	314.64	320.33	330.68	351.15	374.68	392.27	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	5.98	x	46.75	x	0.5	x	0.8	=	77.5	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)

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South	0.9x	0.77	x	5.98	x	76.57	x	0.5	x	0.8	=	126.92	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	5.98	x	97.53	x	0.5	x	0.8	=	161.68	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	5.98	x	110.23	x	0.5	x	0.8	=	182.73	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	5.98	x	114.87	x	0.5	x	0.8	=	190.42	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	5.98	x	110.55	x	0.5	x	0.8	=	183.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	5.98	x	108.01	x	0.5	x	0.8	=	179.05	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	5.98	x	104.89	x	0.5	x	0.8	=	173.88	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	5.98	x	101.89	x	0.5	x	0.8	=	168.89	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	5.98	x	82.59	x	0.5	x	0.8	=	136.9	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	5.98	x	55.42	x	0.5	x	0.8	=	91.86	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	5.98	x	40.4	x	0.5	x	0.8	=	66.97	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)

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West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	153.34	263.89	365.39	455.34	509.03	504.02	486.55	447.29	396.98	293.09	184.22	130.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	556.11	664.69	753.62	823.3	856.48	831.61	801.19	767.62	727.66	644.25	558.91	523.1	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.86	0.72	0.53	0.38	0.42	0.64	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.17	20.36	20.6	20.82	20.95	20.99	21	21	20.98	20.8	20.43	20.12	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.83	0.66	0.46	0.31	0.34	0.57	0.87	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.02	19.29	19.62	19.91	20.07	20.11	20.11	20.11	20.1	19.9	19.39	18.94	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.48	19.72	20.01	20.28	20.42	20.46	20.47	20.47	20.45	20.26	19.81	19.42	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.48	19.72	20.01	20.28	20.42	20.46	20.47	20.47	20.45	20.26	19.81	19.42	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.93	0.84	0.68	0.49	0.34	0.37	0.6	0.87	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	549.79	645.6	701.28	689.97	582.83	406.64	270.23	283.95	434.01	562.09	544.18	518.72	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1062.34	1037.11	945.47	796.11	610.2	410.14	270.56	284.53	444.32	676.03	889.38	1064.73	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	381.34	263.09	181.68	76.42	20.36	0	0	0	0	84.77	248.54	406.23

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1662.44 (98)

Space heating requirement in kWh/m²/year 22.96 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1662.44	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1309.17	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	436.39	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2049.68	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1614.12	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	538.04	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	38.98	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.86	(330a)

warm air heating system fans					0	(330b)
pump for solar water heating					0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =				46.86	(331)
Energy for lighting (calculated in Appendix L)					319.42	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit					32	(361)
Heat efficiency of CHP unit					38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**	**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	3445.19	x	0.22	744.16	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1102.46	x	0.52	-572.18	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4247.69	x	0.22	917.5	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1359.26	x	0.52	-705.46	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22 =	226.32	(368)
Electrical energy for heat distribution	[(313) x			0.52 =	20.23	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)			=	630.58	(373)
CO2 associated with space heating (secondary)	(309) x			0 =	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22 =	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				630.58	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52 =	24.32	(378)
CO2 associated with electricity for lighting	(332))) x			0.52 =	165.78	(379)
Total CO2, kg/year	sum of (376)…(382) =				820.68	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				11.33	(384)
EI rating (section 14)					90.63	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-3-04

Address :	Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	72.42	(1a) x	2.4	(2a) =	173.81	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		173.81	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.94	x1/[1/(1.4)+ 0.04]		=	7.87			(27)
Windows Type 2			2.74	x1/[1/(1.4)+ 0.04]		=	3.63			(27)
Windows Type 3			2.74	x1/[1/(1.4)+ 0.04]		=	3.63			(27)
Windows Type 4			1.83	x1/[1/(1.4)+ 0.04]		=	2.43			(27)
Windows Type 5			2.74	x1/[1/(1.4)+ 0.04]		=	3.63			(27)
Walls Type1	46.63	15.99	30.64	x	0.18	=	5.52			(29)
Walls Type2	26.01	2.1	23.91	x	0.18	=	4.3			(29)
Total area of elements, m²			72.64							(31)
Party wall			20.62	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.12 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.99 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 39.1 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	34.69	34.46	34.23	33.16	32.95	32.02	32.02	31.84	32.38	32.95	33.36	33.79	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.8	73.56	73.34	72.26	72.06	71.12	71.12	70.95	71.48	72.06	72.47	72.89	

Average = Sum(39)1…12 /12= 72.26 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.02	1.02	1.01	1	1	0.98	0.98	0.98	0.99	1	1	1.01	

Average = Sum(40)1…12 /12= 1 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.3 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.91 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.8	94.24	90.68	87.13	83.57	80.02	80.02	83.57	87.13	90.68	94.24	97.8	

Total = Sum(44)1…12 = 1066.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.03	126.84	130.89	114.11	109.5	94.49	87.56	100.47	101.67	118.49	129.34	140.45	

Total = Sum(45)1…12 = 1398.84 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.75	19.03	19.63	17.12	16.42	14.17	13.13	15.07	15.25	17.77	19.4	21.07	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.62	168.93	177.49	159.21	156.09	139.58	134.15	147.07	146.76	165.08	174.43	187.05	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.62	168.93	177.49	159.21	156.09	139.58	134.15	147.07	146.76	165.08	174.43	187.05	

Output from water heater (annual)$_{1...12}$	1947.46	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.5	75.84	80.8	74.02	73.68	67.49	66.39	70.68	69.88	76.67	79.08	83.98	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.09	16.07	13.07	9.89	7.4	6.24	6.75	8.77	11.77	14.94	17.44	18.59	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	202.88	204.98	199.68	188.38	174.13	160.73	151.78	149.67	154.98	166.27	180.53	193.93	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	(71)

Water heating gains (Table 5)

(72)m=	114.92	112.86	108.6	102.8	99.04	93.74	89.23	95	97.05	103.06	109.83	112.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	396.44	394.47	381.9	361.63	341.11	321.26	308.31	313.99	324.35	344.82	368.35	385.94	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	5.94	x	46.75	x	0.63	x	0.7	=	84.87	(78)
South	0.9x	0.77	x	2.74	x	46.75	x	0.63	x	0.7	=	39.15	(78)

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South	0.9x	0.77	x	5.94	x	76.57	x	0.63	x	0.7	=	139	(78)
South	0.9x	0.77	x	2.74	x	76.57	x	0.63	x	0.7	=	64.12	(78)
South	0.9x	0.77	x	5.94	x	97.53	x	0.63	x	0.7	=	177.06	(78)
South	0.9x	0.77	x	2.74	x	97.53	x	0.63	x	0.7	=	81.67	(78)
South	0.9x	0.77	x	5.94	x	110.23	x	0.63	x	0.7	=	200.11	(78)
South	0.9x	0.77	x	2.74	x	110.23	x	0.63	x	0.7	=	92.31	(78)
South	0.9x	0.77	x	5.94	x	114.87	x	0.63	x	0.7	=	208.53	(78)
South	0.9x	0.77	x	2.74	x	114.87	x	0.63	x	0.7	=	96.19	(78)
South	0.9x	0.77	x	5.94	x	110.55	x	0.63	x	0.7	=	200.68	(78)
South	0.9x	0.77	x	2.74	x	110.55	x	0.63	x	0.7	=	92.57	(78)
South	0.9x	0.77	x	5.94	x	108.01	x	0.63	x	0.7	=	196.08	(78)
South	0.9x	0.77	x	2.74	x	108.01	x	0.63	x	0.7	=	90.45	(78)
South	0.9x	0.77	x	5.94	x	104.89	x	0.63	x	0.7	=	190.42	(78)
South	0.9x	0.77	x	2.74	x	104.89	x	0.63	x	0.7	=	87.84	(78)
South	0.9x	0.77	x	5.94	x	101.89	x	0.63	x	0.7	=	184.96	(78)
South	0.9x	0.77	x	2.74	x	101.89	x	0.63	x	0.7	=	85.32	(78)
South	0.9x	0.77	x	5.94	x	82.59	x	0.63	x	0.7	=	149.92	(78)
South	0.9x	0.77	x	2.74	x	82.59	x	0.63	x	0.7	=	69.16	(78)
South	0.9x	0.77	x	5.94	x	55.42	x	0.63	x	0.7	=	100.6	(78)
South	0.9x	0.77	x	2.74	x	55.42	x	0.63	x	0.7	=	46.41	(78)
South	0.9x	0.77	x	5.94	x	40.4	x	0.63	x	0.7	=	73.34	(78)
South	0.9x	0.77	x	2.74	x	40.4	x	0.63	x	0.7	=	33.83	(78)
West	0.9x	0.77	x	2.74	x	19.64	x	0.63	x	0.7	=	16.45	(80)
West	0.9x	0.77	x	1.83	x	19.64	x	0.63	x	0.7	=	10.98	(80)
West	0.9x	0.77	x	2.74	x	19.64	x	0.63	x	0.7	=	16.45	(80)
West	0.9x	0.77	x	2.74	x	38.42	x	0.63	x	0.7	=	32.17	(80)
West	0.9x	0.77	x	1.83	x	38.42	x	0.63	x	0.7	=	21.49	(80)
West	0.9x	0.77	x	2.74	x	38.42	x	0.63	x	0.7	=	32.17	(80)
West	0.9x	0.77	x	2.74	x	63.27	x	0.63	x	0.7	=	52.98	(80)
West	0.9x	0.77	x	1.83	x	63.27	x	0.63	x	0.7	=	35.39	(80)
West	0.9x	0.77	x	2.74	x	63.27	x	0.63	x	0.7	=	52.98	(80)
West	0.9x	0.77	x	2.74	x	92.28	x	0.63	x	0.7	=	77.27	(80)
West	0.9x	0.77	x	1.83	x	92.28	x	0.63	x	0.7	=	51.61	(80)
West	0.9x	0.77	x	2.74	x	92.28	x	0.63	x	0.7	=	77.27	(80)
West	0.9x	0.77	x	2.74	x	113.09	x	0.63	x	0.7	=	94.7	(80)
West	0.9x	0.77	x	1.83	x	113.09	x	0.63	x	0.7	=	63.25	(80)
West	0.9x	0.77	x	2.74	x	113.09	x	0.63	x	0.7	=	94.7	(80)
West	0.9x	0.77	x	2.74	x	115.77	x	0.63	x	0.7	=	96.94	(80)
West	0.9x	0.77	x	1.83	x	115.77	x	0.63	x	0.7	=	64.75	(80)
West	0.9x	0.77	x	2.74	x	115.77	x	0.63	x	0.7	=	96.94	(80)
West	0.9x	0.77	x	2.74	x	110.22	x	0.63	x	0.7	=	92.29	(80)

West	0.9x	0.77	x	1.83	x	110.22	x	0.63	x	0.7	=	61.64	(80)
West	0.9x	0.77	x	2.74	x	110.22	x	0.63	x	0.7	=	92.29	(80)
West	0.9x	0.77	x	2.74	x	94.68	x	0.63	x	0.7	=	79.28	(80)
West	0.9x	0.77	x	1.83	x	94.68	x	0.63	x	0.7	=	52.95	(80)
West	0.9x	0.77	x	2.74	x	94.68	x	0.63	x	0.7	=	79.28	(80)
West	0.9x	0.77	x	2.74	x	73.59	x	0.63	x	0.7	=	61.62	(80)
West	0.9x	0.77	x	1.83	x	73.59	x	0.63	x	0.7	=	41.16	(80)
West	0.9x	0.77	x	2.74	x	73.59	x	0.63	x	0.7	=	61.62	(80)
West	0.9x	0.77	x	2.74	x	45.59	x	0.63	x	0.7	=	38.18	(80)
West	0.9x	0.77	x	1.83	x	45.59	x	0.63	x	0.7	=	25.5	(80)
West	0.9x	0.77	x	2.74	x	45.59	x	0.63	x	0.7	=	38.18	(80)
West	0.9x	0.77	x	2.74	x	24.49	x	0.63	x	0.7	=	20.51	(80)
West	0.9x	0.77	x	1.83	x	24.49	x	0.63	x	0.7	=	13.7	(80)
West	0.9x	0.77	x	2.74	x	24.49	x	0.63	x	0.7	=	20.51	(80)
West	0.9x	0.77	x	2.74	x	16.15	x	0.63	x	0.7	=	13.52	(80)
West	0.9x	0.77	x	1.83	x	16.15	x	0.63	x	0.7	=	9.03	(80)
West	0.9x	0.77	x	2.74	x	16.15	x	0.63	x	0.7	=	13.52	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	167.9	288.95	400.08	498.58	557.37	551.89	532.76	489.76	434.67	320.92	201.72	143.25	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	564.33	683.41	781.98	860.21	898.48	873.15	841.06	803.76	759.03	665.75	570.07	529.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.86	0.7	0.52	0.37	0.4	0.63	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.32	20.57	20.82	20.95	20.99	21	21	20.98	20.8	20.4	20.07	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.07	20.07	20.07	20.09	20.09	20.1	20.1	20.1	20.09	20.09	20.08	20.08	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.82	0.65	0.45	0.3	0.33	0.55	0.86	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.89	19.19	19.55	19.89	20.04	20.09	20.1	20.1	20.08	19.87	19.33	18.85	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.38	19.64	19.96	20.26	20.41	20.45	20.46	20.46	20.44	20.24	19.76	19.34	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.38	19.64	19.96	20.26	20.41	20.45	20.46	20.46	20.44	20.24	19.76	19.34	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

TER WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.93	0.83	0.67	0.47	0.33	0.36	0.58	0.87	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	557.8	663.01	725.31	712.91	599.97	413.13	274.11	287.48	443.14	577.31	554.57	524.65	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1112.68	1084.47	986.9	820.78	627.32	416.32	274.42	288	453.16	694.7	917.45	1103.25	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	412.83	283.22	194.62	77.66	20.35	0	0	0	0	87.34	261.27	430.47

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1767.78 (98)

Space heating requirement in kWh/m²/year 24.41 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	412.83	283.22	194.62	77.66	20.35	0	0	0	0	87.34	261.27	430.47	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	441.53	302.91	208.15	83.06	21.76	0	0	0	0	93.41	279.44	460.4	(211)

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1890.68 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

191.62	168.93	177.49	159.21	156.09	139.58	134.15	147.07	146.76	165.08	174.43	187.05

Efficiency of water heater 79.8 (216)

(217)m=	86.81	86.18	85.06	83.02	80.9	79.8	79.8	79.8	79.8	83.2	85.89	86.97	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	220.74	196.01	208.66	191.77	192.93	174.91	168.11	184.29	183.91	198.41	203.09	215.08

Total = Sum(219a)$_{1...12}$ = 2337.92 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1890.68
Water heating fuel used		2337.92
Electricity for pumps, fans and electric keep-hot		

central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			319.49	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	408.39	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	504.99	(264)
Space and water heating	(261) + (262) + (263) + (264) =			913.38	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	165.82	(268)
Total CO2, kg/year		sum of (265)…(271) =		1118.12	(272)

TER = 15.44 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-3-05

Address :	Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		**Av. Height(m)**		**Volume(m³)**	
Ground floor	120.39	(1a) x	2.4	(2a) =	288.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	120.39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	288.94	(5)

2. Ventilation rate:

	main heating		**secondary heating**		**other**		**total**		**m³ per hour**	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.06	x1/[1/(1.2)+ 0.04]		=	5.79			(27)
Windows Type 2			3.68	x1/[1/(1.2)+ 0.04]		=	4.21			(27)
Windows Type 3			3.22	x1/[1/(1.2)+ 0.04]		=	3.69			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	32.79	17.48	15.31	x	0.18	=	2.76			(29)
Walls Type2	25.04	2.1	22.94	x	0.18	=	4.13			(29)
Total area of elements, m²			57.83							(31)
Party wall			61.8	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 29.42 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.98 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 41.4 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	89.07	89.07	89.07	89.07	89.07	89.07	89.07	89.07	89.07	89.07	89.07	89.07

Average = Sum(39)$_{1...12}$ /12= 89.07 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74

Average = Sum(40)$_{1...12}$ /12= 0.74 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.86 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 102.24 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	112.46	108.37	104.28	100.19	96.1	92.02	92.02	96.1	100.19	104.28	108.37	112.46

Total = Sum(44)$_{1...12}$ = 1226.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.78	145.87	150.52	131.23	125.92	108.66	100.69	115.54	116.92	136.26	148.74	161.52

Total = Sum(45)$_{1...12}$ = 1608.62 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.02	21.88	22.58	19.68	18.89	16.3	15.1	17.33	17.54	20.44	22.31	24.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

DER WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	222.06	195.79	205.8	184.72	181.19	162.15	155.96	170.82	170.41	191.53	202.23	216.79	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	222.06	195.79	205.8	184.72	181.19	162.15	155.96	170.82	170.41	191.53	202.23	216.79	

Output from water heater (annual) 1…12	2259.46	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	99.68	88.44	94.27	86.43	86.09	78.92	77.7	82.64	81.67	89.53	92.25	97.93	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	26.39	23.44	19.06	14.43	10.79	9.11	9.84	12.79	17.17	21.8	25.44	27.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	285.72	288.68	281.21	265.31	245.23	226.36	213.75	210.79	218.26	234.16	254.24	273.11	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	(71)

Water heating gains (Table 5)

(72)m=	133.97	131.61	126.71	120.04	115.71	109.62	104.43	111.07	113.43	120.33	128.12	131.62	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	512.05	509.71	492.95	465.75	437.7	411.05	394	400.62	414.83	442.27	473.78	497.83	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.06	x	10.63	x	0.5	x	0.8	=	14.91	(74)
North	0.9x	0.77	x	3.68	x	10.63	x	0.5	x	0.8	=	10.85	(74)

North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.5	x	0.8	=	28.5	(74)
North	0.9x	0.77	x	3.68	x	20.32	x	0.5	x	0.8	=	20.73	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.5	x	0.8	=	48.43	(74)
North	0.9x	0.77	x	3.68	x	34.53	x	0.5	x	0.8	=	35.22	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.5	x	0.8	=	77.8	(74)
North	0.9x	0.77	x	3.68	x	55.46	x	0.5	x	0.8	=	56.58	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.5	x	0.8	=	104.8	(74)
North	0.9x	0.77	x	3.68	x	74.72	x	0.5	x	0.8	=	76.22	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.5	x	0.8	=	112.19	(74)
North	0.9x	0.77	x	3.68	x	79.99	x	0.5	x	0.8	=	81.59	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.5	x	0.8	=	104.74	(74)
North	0.9x	0.77	x	3.68	x	74.68	x	0.5	x	0.8	=	76.18	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.5	x	0.8	=	83.1	(74)
North	0.9x	0.77	x	3.68	x	59.25	x	0.5	x	0.8	=	60.44	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.5	x	0.8	=	58.23	(74)
North	0.9x	0.77	x	3.68	x	41.52	x	0.5	x	0.8	=	42.35	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.5	x	0.8	=	33.93	(74)
North	0.9x	0.77	x	3.68	x	24.19	x	0.5	x	0.8	=	24.68	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.06	x	13.12	x	0.5	x	0.8	=	18.4	(74)
North	0.9x	0.77	x	3.68	x	13.12	x	0.5	x	0.8	=	13.38	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)

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North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.5	x	0.8	=	12.43	(74)
North	0.9x	0.77	x	3.68	x	8.86	x	0.5	x	0.8	=	9.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
South	0.9x	0.77	x	3.22	x	46.75	x	0.5	x	0.8	=	41.73	(78)
South	0.9x	0.77	x	3.22	x	76.57	x	0.5	x	0.8	=	68.34	(78)
South	0.9x	0.77	x	3.22	x	97.53	x	0.5	x	0.8	=	87.06	(78)
South	0.9x	0.77	x	3.22	x	110.23	x	0.5	x	0.8	=	98.39	(78)
South	0.9x	0.77	x	3.22	x	114.87	x	0.5	x	0.8	=	102.53	(78)
South	0.9x	0.77	x	3.22	x	110.55	x	0.5	x	0.8	=	98.67	(78)
South	0.9x	0.77	x	3.22	x	108.01	x	0.5	x	0.8	=	96.41	(78)
South	0.9x	0.77	x	3.22	x	104.89	x	0.5	x	0.8	=	93.63	(78)
South	0.9x	0.77	x	3.22	x	101.89	x	0.5	x	0.8	=	90.94	(78)
South	0.9x	0.77	x	3.22	x	82.59	x	0.5	x	0.8	=	73.71	(78)
South	0.9x	0.77	x	3.22	x	55.42	x	0.5	x	0.8	=	49.46	(78)
South	0.9x	0.77	x	3.22	x	40.4	x	0.5	x	0.8	=	36.06	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	83.76	148.67	223.55	317.64	397.87	414.85	391.6	327.82	255.05	169.33	101.32	71.1	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	595.82	658.38	716.5	783.39	835.57	825.9	785.6	728.44	669.88	611.6	575.1	568.93	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.88	0.68	0.5	0.56	0.84	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.25	20.34	20.51	20.73	20.92	20.99	21	21	20.96	20.73	20.44	20.22	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.31	20.31	20.31	20.31	20.31	20.31	20.31	20.31	20.31	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.96	0.84	0.61	0.42	0.48	0.78	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.28	19.42	19.66	19.98	20.22	20.3	20.31	20.3	20.27	19.97	19.56	19.24	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.57	19.7	19.92	20.21	20.43	20.51	20.51	20.51	20.47	20.2	19.83	19.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.57	19.7	19.92	20.21	20.43	20.51	20.51	20.51	20.47	20.2	19.83	19.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.96	0.85	0.63	0.44	0.5	0.8	0.97	1	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	594.98	656.23	709.4	751.23	706.19	518.63	348.04	365.07	532.79	595.27	573.03	568.35	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1360.18	1318.19	1195.23	1007.07	777.78	526.04	348.58	366.32	567.79	855.08	1133.45	1365.55	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	569.31	444.83	361.46	184.2	53.26	0	0	0	0	193.3	403.5	593.12

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2802.98 (98)

Space heating requirement in kWh/m²/year 23.28 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2802.98	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	2207.34	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	735.78	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2259.46	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1779.33	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	593.11	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	53.16	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		77.9	(330a)

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warm air heating system fans					0	(330b)
pump for solar water heating					0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =				77.9	(331)
Energy for lighting (calculated in Appendix L)					466.03	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit					32	(361)
Heat efficiency of CHP unit					38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**	**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	5808.8	x	0.22	1254.7	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1858.82	x	0.52	-964.73	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4682.43	x	0.22	1011.41	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1498.38	x	0.52	-777.66	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22 =	308.65	(368)
Electrical energy for heat distribution	[(313) x			0.52 =	27.59	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)			=	859.96	(373)
CO2 associated with space heating (secondary)	(309) x			0 =	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22 =	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				859.96	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52 =	40.43	(378)
CO2 associated with electricity for lighting	(332))) x			0.52 =	241.87	(379)
Total CO2, kg/year	sum of (376)…(382) =				1142.26	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				9.49	(384)
EI rating (section 14)					90.75	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-3-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	120.39	(1a) x	2.4	(2a) =	288.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	120.39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	288.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.39	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.31	0.33	0.35	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.06	x1/[1/(1.4)+ 0.04]		=	6.71			(27)
Windows Type 2			3.68	x1/[1/(1.4)+ 0.04]		=	4.88			(27)
Windows Type 3			3.22	x1/[1/(1.4)+ 0.04]		=	4.27			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 5			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	32.79	17.48	15.31	x	0.18	=	2.76			(29)
Walls Type2	25.04	2.1	22.94	x	0.18	=	4.13			(29)
Total area of elements, m²			57.83							(31)
Party wall			61.8	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	32.16	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		4.95	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	37.11	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	56.12	55.8	55.47	53.96	53.68	52.36	52.36	52.12	52.87	53.68	54.25	54.85	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	93.23	92.91	92.58	91.07	90.79	89.48	89.48	89.23	89.98	90.79	91.36	91.96	

Average = Sum(39)$_{1…12}$ /12= 91.07 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.77	0.77	0.77	0.76	0.75	0.74	0.74	0.74	0.75	0.75	0.76	0.76

Average = Sum(40)$_{1…12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.86 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 102.24 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	112.46	108.37	104.28	100.19	96.1	92.02	92.02	96.1	100.19	104.28	108.37	112.46

Total = Sum(44)$_{1…12}$ = 1226.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.78	145.87	150.52	131.23	125.92	108.66	100.69	115.54	116.92	136.26	148.74	161.52

Total = Sum(45)$_{1…12}$ = 1608.62 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.02	21.88	22.58	19.68	18.89	16.3	15.1	17.33	17.54	20.44	22.31	24.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	213.37	187.95	197.12	176.32	172.51	153.75	147.28	162.13	162.01	182.85	193.83	208.11	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	213.37	187.95	197.12	176.32	172.51	153.75	147.28	162.13	162.01	182.85	193.83	208.11

Output from water heater (annual)$_{1…12}$ | 2157.24 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.73	82.17	87.32	79.71	79.14	72.2	70.75	75.69	74.95	82.58	85.53	90.98	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	27.11	24.08	19.58	14.83	11.08	9.36	10.11	13.14	17.64	22.4	26.14	27.87	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	285.72	288.68	281.21	265.31	245.23	226.36	213.75	210.79	218.26	234.16	254.24	273.11	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	(71)

Water heating gains (Table 5)

(72)m=	124.64	122.28	117.37	110.7	106.38	100.28	95.1	101.74	104.1	111	118.79	122.29	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	506.44	504.01	487.14	459.81	431.66	404.97	387.93	394.64	408.97	436.53	468.14	492.24	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.06	x	10.63	x	0.63	x	0.7	=	16.44	(74)
North	0.9x	0.77	x	3.68	x	10.63	x	0.63	x	0.7	=	11.96	(74)

North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.63	x	0.7	=	31.42	(74)
North	0.9x	0.77	x	3.68	x	20.32	x	0.63	x	0.7	=	22.85	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.63	x	0.7	=	53.4	(74)
North	0.9x	0.77	x	3.68	x	34.53	x	0.63	x	0.7	=	38.83	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.63	x	0.7	=	85.77	(74)
North	0.9x	0.77	x	3.68	x	55.46	x	0.63	x	0.7	=	62.38	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.63	x	0.7	=	115.54	(74)
North	0.9x	0.77	x	3.68	x	74.72	x	0.63	x	0.7	=	84.03	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.63	x	0.7	=	123.69	(74)
North	0.9x	0.77	x	3.68	x	79.99	x	0.63	x	0.7	=	89.96	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.63	x	0.7	=	115.48	(74)
North	0.9x	0.77	x	3.68	x	74.68	x	0.63	x	0.7	=	83.99	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.63	x	0.7	=	91.62	(74)
North	0.9x	0.77	x	3.68	x	59.25	x	0.63	x	0.7	=	66.63	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.63	x	0.7	=	64.2	(74)
North	0.9x	0.77	x	3.68	x	41.52	x	0.63	x	0.7	=	46.69	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.63	x	0.7	=	37.41	(74)
North	0.9x	0.77	x	3.68	x	24.19	x	0.63	x	0.7	=	27.2	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	5.06	x	13.12	x	0.63	x	0.7	=	20.29	(74)
North	0.9x	0.77	x	3.68	x	13.12	x	0.63	x	0.7	=	14.75	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)

North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.63	x	0.7	=	13.71	(74)
North	0.9x	0.77	x	3.68	x	8.86	x	0.63	x	0.7	=	9.97	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
South	0.9x	0.77	x	3.22	x	46.75	x	0.63	x	0.7	=	46.01	(78)
South	0.9x	0.77	x	3.22	x	76.57	x	0.63	x	0.7	=	75.35	(78)
South	0.9x	0.77	x	3.22	x	97.53	x	0.63	x	0.7	=	95.98	(78)
South	0.9x	0.77	x	3.22	x	110.23	x	0.63	x	0.7	=	108.48	(78)
South	0.9x	0.77	x	3.22	x	114.87	x	0.63	x	0.7	=	113.04	(78)
South	0.9x	0.77	x	3.22	x	110.55	x	0.63	x	0.7	=	108.79	(78)
South	0.9x	0.77	x	3.22	x	108.01	x	0.63	x	0.7	=	106.29	(78)
South	0.9x	0.77	x	3.22	x	104.89	x	0.63	x	0.7	=	103.22	(78)
South	0.9x	0.77	x	3.22	x	101.89	x	0.63	x	0.7	=	100.26	(78)
South	0.9x	0.77	x	3.22	x	82.59	x	0.63	x	0.7	=	81.27	(78)
South	0.9x	0.77	x	3.22	x	55.42	x	0.63	x	0.7	=	54.53	(78)
South	0.9x	0.77	x	3.22	x	40.4	x	0.63	x	0.7	=	39.75	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	92.35	163.91	246.46	350.2	438.66	457.37	431.74	361.42	281.19	186.69	111.7	78.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	598.79	667.92	733.61	810.01	870.32	862.33	819.67	756.06	690.16	623.22	579.85	570.62	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.86	0.65	0.48	0.54	0.83	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.2	20.31	20.49	20.73	20.92	20.99	21	21	20.96	20.72	20.42	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.28	20.28	20.28	20.29	20.29	20.3	20.3	20.3	20.3	20.29	20.29	20.28	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.96	0.82	0.59	0.4	0.46	0.77	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.18	19.34	19.61	19.97	20.22	20.3	20.3	20.3	20.26	19.96	19.52	19.17	(90)

fLA = Living area ÷ (4) = | 0.3 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.63	19.87	20.2	20.43	20.51	20.51	20.51	20.47	20.19	19.79	19.47	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.63	19.87	20.2	20.43	20.51	20.51	20.51	20.47	20.19	19.79	19.47	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.95	0.83	0.61	0.43	0.48	0.78	0.97	1	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	597.94	665.66	725.9	773.37	724.38	522.34	349.56	365.92	540.67	605.76	577.72	570.04	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1415.93	1368.61	1237.88	1028.9	792.4	528.38	349.98	366.93	573.42	870.31	1159.25	1404.42	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	608.59	472.38	380.91	183.98	50.61	0	0	0	0	196.83	418.7	620.78

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2932.79 (98)

Space heating requirement in kWh/m²/year 24.36 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	608.59	472.38	380.91	183.98	50.61	0	0	0	0	196.83	418.7	620.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	650.9	505.22	407.39	196.77	54.13	0	0	0	0	210.51	447.81	663.94	(211)

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3136.67 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

213.37	187.95	197.12	176.32	172.51	153.75	147.28	162.13	162.01	182.85	193.83	208.11

Efficiency of water heater 79.8 (216)

(217)m=	87.46	87.17	86.54	84.93	82	79.8	79.8	79.8	79.8	85.01	86.82	87.55	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	243.98	215.61	227.77	207.61	210.38	192.67	184.56	203.17	203.02	215.09	223.26	237.7

Total = Sum(219a)$_{1...12}$ = 2564.83 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3136.67
Water heating fuel used		2564.83
Electricity for pumps, fans and electric keep-hot		

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central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			478.82	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	677.52	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	554	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1231.52	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	248.51	(268)
Total CO2, kg/year		sum of (265)…(271) =		1518.96	(272)

TER = 12.62 (273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-4-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	120.39	(1a) x	2.4	(2a) =	288.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	120.39	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		288.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			3.68	x1/[1/(1.2)+ 0.04]		=	4.21			(27)
Windows Type 2			5.06	x1/[1/(1.2)+ 0.04]		=	5.79			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			3.22	x1/[1/(1.2)+ 0.04]		=	3.69			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	32.79	17.48	15.31	x	0.18	=	2.76			(29)
Walls Type2	25.04	2.1	22.94	x	0.18	=	4.13			(29)
Roof	34.94	0	34.94	x	0.11	=	3.84			(30)
Total area of elements, m²			92.77							(31)
Party wall			61.8	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.26 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.75 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 49.01 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	96.68	96.68	96.68	96.68	96.68	96.68	96.68	96.68	96.68	96.68	96.68	96.68	

Average = Sum(39)$_{1...12}$ /12= 96.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.86 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 102.24 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	112.46	108.37	104.28	100.19	96.1	92.02	92.02	96.1	100.19	104.28	108.37	112.46

Total = Sum(44)$_{1...12}$ = 1226.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.78	145.87	150.52	131.23	125.92	108.66	100.69	115.54	116.92	136.26	148.74	161.52

Total = Sum(45)$_{1...12}$ = 1608.62 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.02	21.88	22.58	19.68	18.89	16.3	15.1	17.33	17.54	20.44	22.31	24.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	222.06	195.79	205.8	184.72	181.19	162.15	155.96	170.82	170.41	191.53	202.23	216.79	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	222.06	195.79	205.8	184.72	181.19	162.15	155.96	170.82	170.41	191.53	202.23	216.79

Output from water heater (annual)$_{1...12}$ | 2259.46 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	99.68	88.44	94.27	86.43	86.09	78.92	77.7	82.64	81.67	89.53	92.25	97.93	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	26.39	23.44	19.06	14.43	10.79	9.11	9.84	12.79	17.17	21.8	25.44	27.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	285.72	288.68	281.21	265.31	245.23	226.36	213.75	210.79	218.26	234.16	254.24	273.11	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	(71)

Water heating gains (Table 5)

(72)m=	133.97	131.61	126.71	120.04	115.71	109.62	104.43	111.07	113.43	120.33	128.12	131.62	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	512.05	509.71	492.95	465.75	437.7	411.05	394	400.62	414.83	442.27	473.78	497.83	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	3.68	x	10.63	x	0.5	x	0.8	=	10.85	(74)
North	0.9x	0.77	x	5.06	x	10.63	x	0.5	x	0.8	=	14.91	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	3.68	x	20.32	x	0.5	x	0.8	=	20.73	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.5	x	0.8	=	28.5	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	3.68	x	34.53	x	0.5	x	0.8	=	35.22	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.5	x	0.8	=	48.43	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	3.68	x	55.46	x	0.5	x	0.8	=	56.58	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.5	x	0.8	=	77.8	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	3.68	x	74.72	x	0.5	x	0.8	=	76.22	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.5	x	0.8	=	104.8	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	3.68	x	79.99	x	0.5	x	0.8	=	81.59	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.5	x	0.8	=	112.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	3.68	x	74.68	x	0.5	x	0.8	=	76.18	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.5	x	0.8	=	104.74	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	3.68	x	59.25	x	0.5	x	0.8	=	60.44	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.5	x	0.8	=	83.1	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	3.68	x	41.52	x	0.5	x	0.8	=	42.35	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.5	x	0.8	=	58.23	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	3.68	x	24.19	x	0.5	x	0.8	=	24.68	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.5	x	0.8	=	33.93	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	3.68	x	13.12	x	0.5	x	0.8	=	13.38	(74)

North	0.9x	0.77	x	5.06	x	13.12	x	0.5	x	0.8	=	18.4	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	3.68	x	8.86	x	0.5	x	0.8	=	9.04	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.5	x	0.8	=	12.43	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
South	0.9x	0.77	x	3.22	x	46.75	x	0.5	x	0.8	=	41.73	(78)
South	0.9x	0.77	x	3.22	x	76.57	x	0.5	x	0.8	=	68.34	(78)
South	0.9x	0.77	x	3.22	x	97.53	x	0.5	x	0.8	=	87.06	(78)
South	0.9x	0.77	x	3.22	x	110.23	x	0.5	x	0.8	=	98.39	(78)
South	0.9x	0.77	x	3.22	x	114.87	x	0.5	x	0.8	=	102.53	(78)
South	0.9x	0.77	x	3.22	x	110.55	x	0.5	x	0.8	=	98.67	(78)
South	0.9x	0.77	x	3.22	x	108.01	x	0.5	x	0.8	=	96.41	(78)
South	0.9x	0.77	x	3.22	x	104.89	x	0.5	x	0.8	=	93.63	(78)
South	0.9x	0.77	x	3.22	x	101.89	x	0.5	x	0.8	=	90.94	(78)
South	0.9x	0.77	x	3.22	x	82.59	x	0.5	x	0.8	=	73.71	(78)
South	0.9x	0.77	x	3.22	x	55.42	x	0.5	x	0.8	=	49.46	(78)
South	0.9x	0.77	x	3.22	x	40.4	x	0.5	x	0.8	=	36.06	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	83.76	148.67	223.55	317.64	397.87	414.85	391.6	327.82	255.05	169.33	101.32	71.1	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	595.82	658.38	716.5	783.39	835.57	825.9	785.6	728.44	669.88	611.6	575.1	568.93	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.9	0.72	0.54	0.6	0.87	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.25	20.43	20.66	20.88	20.98	21	20.99	20.93	20.66	20.36	20.12	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.97	0.87	0.65	0.45	0.51	0.81	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.1	19.24	19.5	19.84	20.13	20.24	20.25	20.25	20.19	19.84	19.4	19.05	(90)

fLA = Living area ÷ (4) = | 0.3 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.41	19.54	19.78	20.09	20.35	20.46	20.47	20.47	20.41	20.09	19.69	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.41	19.54	19.78	20.09	20.35	20.46	20.47	20.47	20.41	20.09	19.69	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.97	0.87	0.67	0.48	0.54	0.83	0.98	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	595	656.39	710.3	756.83	728.34	551.82	373.24	390.88	554.14	597.89	573.19	568.35	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1461.12	1415.89	1283.54	1081.43	836.43	566.5	374.55	393.72	610.28	917.51	1216.99	1466.91	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	644.4	510.38	426.49	233.71	80.42	0	0	0	0	237.79	463.54	668.53	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3265.26 (98)

Space heating requirement in kWh/m²/year 27.12 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		3265.26	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	2571.39	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	857.13	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2259.46	
If DHW from community scheme:			
Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1779.33	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	593.11	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	58.01	(313)

DER WorkSheet: New dwelling design stage

Cooling System Energy Efficiency Ratio					0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =				0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside					77.9	(330a)
warm air heating system fans					0	(330b)
pump for solar water heating					0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =				77.9	(331)
Energy for lighting (calculated in Appendix L)					466.03	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit					32	(361)
Heat efficiency of CHP unit					38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**	**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	6766.82	x	0.22	1461.63	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	2165.38	x	0.52	-1123.83	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4682.43	x	0.22	1011.41	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1498.38	x	0.52	-777.66	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	= 336.83	(368)
Electrical energy for heat distribution	[(313) x			0.52	= 30.11	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				= 938.48	(373)
CO2 associated with space heating (secondary)	(309) x			0	= 0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	= 0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				938.48	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	= 40.43	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	= 241.87	(379)
Total CO2, kg/year	sum of (376)…(382) =				1220.78	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				10.14	(384)
EI rating (section 14)					90.11	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: a1-4-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	120.39	(1a) x	2.4	(2a) =	288.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	120.39	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		288.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.39	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.31	0.33	0.35	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			3.68	x1/[1/(1.4)+ 0.04]		=	4.88			(27)
Windows Type 2			5.06	x1/[1/(1.4)+ 0.04]		=	6.71			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			3.22	x1/[1/(1.4)+ 0.04]		=	4.27			(27)
Windows Type 5			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	32.79	17.48	15.31	x	0.18	=	2.76			(29)
Walls Type2	25.04	2.1	22.94	x	0.18	=	4.13			(29)
Roof	34.94	0	34.94	x	0.13	=	4.54			(30)
Total area of elements, m²			92.77							(31)
Party wall			61.8	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	36.7	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.72 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 45.42 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	56.12	55.8	55.47	53.96	53.68	52.36	52.36	52.12	52.87	53.68	54.25	54.85	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	101.54	101.22	100.89	99.38	99.1	97.79	97.79	97.54	98.29	99.1	99.67	100.27	

Average = $\text{Sum}(39)_{1\ldots12}$ /12= 99.38 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.84	0.84	0.84	0.83	0.82	0.81	0.81	0.81	0.82	0.82	0.83	0.83	

Average = $\text{Sum}(40)_{1\ldots12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.86 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 102.24 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	112.46	108.37	104.28	100.19	96.1	92.02	92.02	96.1	100.19	104.28	108.37	112.46	

Total = $\text{Sum}(44)_{1\ldots12}$ = 1226.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.78	145.87	150.52	131.23	125.92	108.66	100.69	115.54	116.92	136.26	148.74	161.52	

Total = $\text{Sum}(45)_{1\ldots12}$ = 1608.62 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.02	21.88	22.58	19.68	18.89	16.3	15.1	17.33	17.54	20.44	22.31	24.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	213.37	187.95	197.12	176.32	172.51	153.75	147.28	162.13	162.01	182.85	193.83	208.11	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	213.37	187.95	197.12	176.32	172.51	153.75	147.28	162.13	162.01	182.85	193.83	208.11

Output from water heater (annual)$_{1...12}$ — 2157.24 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.73	82.17	87.32	79.71	79.14	72.2	70.75	75.69	74.95	82.58	85.53	90.98	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	27.11	24.08	19.58	14.83	11.08	9.36	10.11	13.14	17.64	22.4	26.14	27.87	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	285.72	288.68	281.21	265.31	245.23	226.36	213.75	210.79	218.26	234.16	254.24	273.11	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	(71)

Water heating gains (Table 5)

(72)m=	124.64	122.28	117.37	110.7	106.38	100.28	95.1	101.74	104.1	111	118.79	122.29	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	506.44	504.01	487.14	459.81	431.66	404.97	387.93	394.64	408.97	436.53	468.14	492.24	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	3.68	x	10.63	x	0.63	x	0.7	=	11.96	(74)
North	0.9x	0.77	x	5.06	x	10.63	x	0.63	x	0.7	=	16.44	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	3.68	x	20.32	x	0.63	x	0.7	=	22.85	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.63	x	0.7	=	31.42	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	3.68	x	34.53	x	0.63	x	0.7	=	38.83	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.63	x	0.7	=	53.4	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	3.68	x	55.46	x	0.63	x	0.7	=	62.38	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.63	x	0.7	=	85.77	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	3.68	x	74.72	x	0.63	x	0.7	=	84.03	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.63	x	0.7	=	115.54	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	3.68	x	79.99	x	0.63	x	0.7	=	89.96	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.63	x	0.7	=	123.69	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	3.68	x	74.68	x	0.63	x	0.7	=	83.99	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.63	x	0.7	=	115.48	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	3.68	x	59.25	x	0.63	x	0.7	=	66.63	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.63	x	0.7	=	91.62	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	3.68	x	41.52	x	0.63	x	0.7	=	46.69	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.63	x	0.7	=	64.2	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	3.68	x	24.19	x	0.63	x	0.7	=	27.2	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.63	x	0.7	=	37.41	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	3.68	x	13.12	x	0.63	x	0.7	=	14.75	(74)

North	0.9x	0.77	x	5.06	x	13.12	x	0.63	x	0.7	=	20.29	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	3.68	x	8.86	x	0.63	x	0.7	=	9.97	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.63	x	0.7	=	13.71	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
South	0.9x	0.77	x	3.22	x	46.75	x	0.63	x	0.7	=	46.01	(78)
South	0.9x	0.77	x	3.22	x	76.57	x	0.63	x	0.7	=	75.35	(78)
South	0.9x	0.77	x	3.22	x	97.53	x	0.63	x	0.7	=	95.98	(78)
South	0.9x	0.77	x	3.22	x	110.23	x	0.63	x	0.7	=	108.48	(78)
South	0.9x	0.77	x	3.22	x	114.87	x	0.63	x	0.7	=	113.04	(78)
South	0.9x	0.77	x	3.22	x	110.55	x	0.63	x	0.7	=	108.79	(78)
South	0.9x	0.77	x	3.22	x	108.01	x	0.63	x	0.7	=	106.29	(78)
South	0.9x	0.77	x	3.22	x	104.89	x	0.63	x	0.7	=	103.22	(78)
South	0.9x	0.77	x	3.22	x	101.89	x	0.63	x	0.7	=	100.26	(78)
South	0.9x	0.77	x	3.22	x	82.59	x	0.63	x	0.7	=	81.27	(78)
South	0.9x	0.77	x	3.22	x	55.42	x	0.63	x	0.7	=	54.53	(78)
South	0.9x	0.77	x	3.22	x	40.4	x	0.63	x	0.7	=	39.75	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	92.35	163.91	246.46	350.2	438.66	457.37	431.74	361.42	281.19	186.69	111.7	78.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	598.79	667.92	733.61	810.01	870.32	862.33	819.67	756.06	690.16	623.22	579.85	570.62	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.89	0.7	0.52	0.59	0.86	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.2	20.39	20.66	20.88	20.98	21	21	20.93	20.65	20.33	20.08	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.22	20.22	20.22	20.23	20.23	20.24	20.24	20.24	20.24	20.23	20.23	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.97	0.86	0.63	0.43	0.49	0.8	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.98	19.15	19.43	19.81	20.11	20.23	20.24	20.24	20.18	19.81	19.34	18.97	(90)

fLA = Living area ÷ (4) = | 0.3 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.32	19.46	19.72	20.07	20.34	20.46	20.47	20.47	20.41	20.07	19.64	19.3	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.32	19.46	19.72	20.07	20.34	20.46	20.47	20.47	20.41	20.07	19.64	19.3	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.96	0.86	0.65	0.46	0.52	0.82	0.98	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	597.95	665.8	726.84	779.95	749.98	559.67	377.15	394.33	564.89	608.64	577.87	570.03	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1524.86	1474.17	1333.41	1109.78	856.4	572.6	378.29	396.83	619.8	938.14	1249.84	1514.17	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	689.63	543.23	451.29	237.48	79.18	0	0	0	0	245.15	483.82	702.44	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3432.2 (98)

Space heating requirement in kWh/m²/year 28.51 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	689.63	543.23	451.29	237.48	79.18	0	0	0	0	245.15	483.82	702.44		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	737.57	580.99	482.66	253.99	84.68	0	0	0	0	262.19	517.45	751.27		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3670.8	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	213.37	187.95	197.12	176.32	172.51	153.75	147.28	162.13	162.01	182.85	193.83	208.11		
Efficiency of water heater													79.8	(216)
(217)m=	87.72	87.48	86.96	85.61	82.88	79.8	79.8	79.8	79.8	85.6	87.16	87.81		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	243.24	214.84	226.69	205.96	208.14	192.67	184.56	203.17	203.02	213.62	222.39	237.01		
Total = Sum(219a)$_{1...12}$ =													2555.31	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3670.8

TER WorkSheet: New dwelling design stage

Water heating fuel used			2555.31	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			478.82	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	792.89	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	551.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1344.84	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	248.51	(268)
Total CO2, kg/year		sum of (265)…(271) =		1632.27	(272)

TER = 13.56 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-5-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	85.47	(1a) x	2.4	(2a) =	205.13	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	85.47	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.13	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			5.06	x1/[1/(1.2)+ 0.04]		=	5.79			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 6			0.01	x1/[1/(1.2)+ 0.04]		=	0.01			(27)
Windows Type 7			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	50.79	18.87	31.92	x	0.18	=	5.75			(29)
Walls Type2	25.04	2.1	22.94	x	0.18	=	4.13			(29)
Total area of elements, m²			75.83							(31)
Party wall			25.74	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	34	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	11.23	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss	(33) + (36) =	45.23 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	79.08	79.08	79.08	79.08	79.08	79.08	79.08	79.08	79.08	79.08	79.08	79.08

Average = Sum(39)$_{1…12}$ /12= 79.08 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93

Average = Sum(40)$_{1…12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.56 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 94.96 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	104.46	100.66	96.86	93.07	89.27	85.47	85.47	89.27	93.07	96.86	100.66	104.46

Total = Sum(44)$_{1…12}$ = 1139.57 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	154.91	135.49	139.81	121.89	116.96	100.92	93.52	107.32	108.6	126.56	138.15	150.02

Total = Sum(45)$_{1…12}$ = 1494.16 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.24	20.32	20.97	18.28	17.54	15.14	14.03	16.1	16.29	18.98	20.72	22.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		0	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)			
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)			
Water storage loss:			
a) If manufacturer's declared loss factor is known (kWh/day):		0	(48)
Temperature factor from Table 2b		0	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	110	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0.02	(51)
If community heating see section 4.3			
Volume factor from Table 2a		1.03	(52)
Temperature factor from Table 2b		0.6	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	1.03	(54)
Enter (50) or (54) in (55)		1.03	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.19	185.41	195.09	175.38	172.23	154.42	148.8	162.59	162.09	181.84	191.65	205.3	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	210.19	185.41	195.09	175.38	172.23	154.42	148.8	162.59	162.09	181.84	191.65	205.3

Output from water heater (annual)$_{1...12}$ | 2145 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	95.73	84.99	90.71	83.32	83.11	76.35	75.32	79.9	78.9	86.3	88.73	94.1	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.55	18.25	14.84	11.24	8.4	7.09	7.66	9.96	13.37	16.97	19.81	21.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	230.49	232.88	226.86	214.03	197.83	182.61	172.44	170.04	176.07	188.9	205.1	220.32	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	(71)

Water heating gains (Table 5)

(72)m=	128.67	126.48	121.92	115.73	111.71	106.05	101.23	107.4	109.59	116	123.24	126.48	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	441.09	438.99	425	402.37	379.31	357.12	342.71	348.78	360.41	383.25	409.53	429.3	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.06	x	10.63	x	0.5	x	0.8	=	14.91	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.5	x	0.8	=	28.5	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.5	x	0.8	=	48.43	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.5	x	0.8	=	77.8	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.5	x	0.8	=	104.8	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.5	x	0.8	=	112.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.5	x	0.8	=	104.74	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.5	x	0.8	=	83.1	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.5	x	0.8	=	58.23	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.5	x	0.8	=	33.93	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.06	x	13.12	x	0.5	x	0.8	=	18.4	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.5	x	0.8	=	12.43	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
South	0.9x	0.77	x	0.01	x	46.75	x	0.5	x	0.8	=	0.13	(78)
South	0.9x	0.77	x	0.01	x	76.57	x	0.5	x	0.8	=	0.21	(78)
South	0.9x	0.77	x	0.01	x	97.53	x	0.5	x	0.8	=	0.27	(78)

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South	0.9x	0.77	x	0.01	x	110.23	x	0.5	x	0.8	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	114.87	x	0.5	x	0.8	=	0.32	(78)
South	0.9x	0.77	x	0.01	x	110.55	x	0.5	x	0.8	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	108.01	x	0.5	x	0.8	=	0.3	(78)
South	0.9x	0.77	x	0.01	x	104.89	x	0.5	x	0.8	=	0.29	(78)
South	0.9x	0.77	x	0.01	x	101.89	x	0.5	x	0.8	=	0.28	(78)
South	0.9x	0.77	x	0.01	x	82.59	x	0.5	x	0.8	=	0.23	(78)
South	0.9x	0.77	x	0.01	x	55.42	x	0.5	x	0.8	=	0.15	(78)
South	0.9x	0.77	x	0.01	x	40.4	x	0.5	x	0.8	=	0.11	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)

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West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	76.39	147.99	246.77	374.77	479.02	500.6	472.28	391.35	290.94	175.81	94.83	63.18	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	517.48	586.98	671.76	777.14	858.33	857.72	814.99	740.13	651.35	559.06	504.36	492.48	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.78	0.58	0.43	0.49	0.77	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.08	20.21	20.44	20.73	20.93	20.99	21	21	20.95	20.68	20.32	20.04	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.91	0.73	0.51	0.34	0.4	0.7	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.1	19.44	19.84	20.08	20.14	20.15	20.14	20.11	19.77	19.26	18.85	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.38	19.54	19.84	20.2	20.42	20.48	20.49	20.49	20.45	20.13	19.68	19.33	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.38	19.54	19.84	20.2	20.42	20.48	20.49	20.49	20.45	20.13	19.68	19.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.91	0.75	0.54	0.38	0.43	0.73	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	515.52	582.04	654.8	706.84	643.06	459.49	306.82	321.84	473.11	531.69	500.11	491.08	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1192.27	1158.1	1054.85	893.23	689.48	464.96	307.37	323.1	501.78	753.92	994.77	1196.41	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	503.5	387.11	297.64	134.2	34.53	0	0	0	0	165.34	356.15	524.77	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 2403.24 | (98)

Space heating requirement in kWh/m²/year | 28.12 | (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2403.24	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1892.55	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	630.85	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2145	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1689.19	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	563.06	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	47.76	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		55.31	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	55.31	(331)
Energy for lighting (calculated in Appendix L)		362.89	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		**Emission factor kg CO2/kWh**	**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4980.4	x	0.22	1075.77	(363)

DER WorkSheet: New dwelling design stage

less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1593.73	x	0.52		-827.14	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4445.23	x	0.22		960.17	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1422.47	x	0.52		-738.26	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	277.3	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	24.79	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	772.61	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					772.61	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	28.7	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	188.34	(379)
Total CO2, kg/year	sum of (376)…(382) =					989.66	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					11.58	(384)
EI rating (section 14)						89.84	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-5-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	85.47	(1a) x	2.4	(2a) =	205.13	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	85.47	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.13	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			5.06	x1/[1/(1.4)+ 0.04]		=	6.71			(27)
Windows Type 5			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 6			0.01	x1/[1/(1.4)+ 0.04]		=	0.01			(27)
Windows Type 7			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	50.79	18.87	31.92	x	0.18	=	5.75			(29)
Walls Type2	25.04	2.1	22.94	x	0.18	=	4.13			(29)
Total area of elements, m²			75.83							(31)
Party wall			25.74	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 36.99 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.93 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

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Total fabric heat loss	(33) + (36) =	41.92	(37)
Ventilation heat loss calculated monthly	(38)m = 0.33 × (25)m x (5)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.09	39.85	39.61	38.49	38.28	37.31	37.31	37.13	37.69	38.28	38.71	39.15	(38)

Heat transfer coefficient, W/K — (39)m = (37) + (38)m

(39)m=	82.01	81.76	81.53	80.41	80.2	79.23	79.23	79.05	79.6	80.2	80.62	81.07	

Average = Sum(39)$_{1…12}$ /12= 80.41 (39)

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	0.96	0.96	0.95	0.94	0.94	0.93	0.93	0.92	0.93	0.94	0.94	0.95	

Average = Sum(40)$_{1…12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.56 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 94.96 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	104.46	100.66	96.86	93.07	89.27	85.47	85.47	89.27	93.07	96.86	100.66	104.46	

Total = Sum(44)$_{1…12}$ = 1139.57 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	154.91	135.49	139.81	121.89	116.96	100.92	93.52	107.32	108.6	126.56	138.15	150.02	

Total = Sum(45)$_{1…12}$ = 1494.16 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.24	20.32	20.97	18.28	17.54	15.14	14.03	16.1	16.29	18.98	20.72	22.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		150	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)			
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)			
Water storage loss:			
a) If manufacturer's declared loss factor is known (kWh/day):		1.39	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0.75	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.75	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.51	177.57	186.41	166.98	163.55	146.02	140.12	153.91	153.69	173.16	183.24	196.62	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.51	177.57	186.41	166.98	163.55	146.02	140.12	153.91	153.69	173.16	183.24	196.62

Output from water heater (annual) 1…12 2042.78 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	88.78	78.72	83.76	76.6	76.16	69.63	68.37	72.96	72.18	79.36	82.01	87.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.55	18.26	14.85	11.24	8.4	7.09	7.66	9.96	13.37	16.98	19.82	21.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	230.49	232.88	226.86	214.03	197.83	182.61	172.44	170.04	176.07	188.9	205.1	220.32	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	(71)

Water heating gains (Table 5)

(72)m=	119.33	117.14	112.58	106.39	102.37	96.71	91.9	98.06	100.25	106.66	113.9	117.15	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	434.76	432.66	418.67	396.04	372.98	350.79	336.38	342.45	354.07	376.92	403.19	422.97	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.06	x	10.63	x	0.63	x	0.7	=	16.44	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.63	x	0.7	=	31.42	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.63	x	0.7	=	53.4	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.63	x	0.7	=	85.77	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.63	x	0.7	=	115.54	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.63	x	0.7	=	123.69	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.63	x	0.7	=	115.48	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.63	x	0.7	=	91.62	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.63	x	0.7	=	64.2	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.63	x	0.7	=	37.41	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	5.06	x	13.12	x	0.63	x	0.7	=	20.29	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.63	x	0.7	=	13.71	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
South	0.9x	0.77	x	0.01	x	46.75	x	0.63	x	0.7	=	0.14	(78)
South	0.9x	0.77	x	0.01	x	76.57	x	0.63	x	0.7	=	0.23	(78)
South	0.9x	0.77	x	0.01	x	97.53	x	0.63	x	0.7	=	0.3	(78)

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South	0.9x	0.77	x	0.01	x	110.23	x	0.63	x	0.7	=	0.34	(78)
South	0.9x	0.77	x	0.01	x	114.87	x	0.63	x	0.7	=	0.35	(78)
South	0.9x	0.77	x	0.01	x	110.55	x	0.63	x	0.7	=	0.34	(78)
South	0.9x	0.77	x	0.01	x	108.01	x	0.63	x	0.7	=	0.33	(78)
South	0.9x	0.77	x	0.01	x	104.89	x	0.63	x	0.7	=	0.32	(78)
South	0.9x	0.77	x	0.01	x	101.89	x	0.63	x	0.7	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	82.59	x	0.63	x	0.7	=	0.25	(78)
South	0.9x	0.77	x	0.01	x	55.42	x	0.63	x	0.7	=	0.17	(78)
South	0.9x	0.77	x	0.01	x	40.4	x	0.63	x	0.7	=	0.12	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)

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West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	84.22	163.16	272.06	413.19	528.11	551.92	520.69	431.46	320.77	193.83	104.55	69.66	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	518.98	595.82	690.72	809.22	901.09	902.7	857.07	773.91	674.84	570.75	507.75	492.63	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.76	0.55	0.41	0.47	0.76	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.03	20.18	20.43	20.74	20.93	20.99	21	21	20.96	20.68	20.3	20.01	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.12	20.12	20.13	20.14	20.14	20.14	20.15	20.14	20.14	20.13	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.9	0.71	0.48	0.33	0.38	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.82	19.03	19.39	19.84	20.08	20.14	20.14	20.15	20.11	19.76	19.22	18.79	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.3	19.49	19.81	20.2	20.42	20.48	20.49	20.49	20.45	20.13	19.65	19.28	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.3	19.49	19.81	20.2	20.42	20.48	20.49	20.49	20.45	20.13	19.65	19.28	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.9	0.73	0.51	0.36	0.42	0.71	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	517.01	590.6	672.01	728.36	657.25	461.59	307.47	322.03	479.2	541.27	503.41	491.22	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1230.32	1192.83	1084.81	908.55	699.28	465.91	307.9	323.03	505.2	764.08	1011.76	1222.27	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	530.7	404.7	307.12	129.73	31.27	0	0	0	0	165.77	366.02	543.9	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 2479.22 | (98)

Space heating requirement in kWh/m²/year | 29.01 | (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	530.7	404.7	307.12	129.73	31.27	0	0	0	0	165.77	366.02	543.9		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	567.6	432.84	328.47	138.75	33.45	0	0	0	0	177.29	391.46	581.71		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													2651.57	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	201.51	177.57	186.41	166.98	163.55	146.02	140.12	153.91	153.69	173.16	183.24	196.62		
Efficiency of water heater													79.8	(216)
(217)m=	87.28	86.94	86.14	84.15	81.34	79.8	79.8	79.8	79.8	84.7	86.62	87.39		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	230.88	204.24	216.4	198.43	201.06	182.98	175.58	192.87	192.6	204.44	211.54	224.99		
Total = Sum(219a)$_{1...12}$ =													2436.02	(219)

Annual totals

		kWh/year	kWh/year	
Space heating fuel used, main system 1			2651.57	
Water heating fuel used			2436.02	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			362.98	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	572.74	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	526.18	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1098.92	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	188.39	(268)
Total CO2, kg/year		sum of (265)…(271) =		1326.23	(272)

TER =	15.52	(273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-8-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.94	(1a) x	2.4	(2a) =	179.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.94	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	179.86	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			5.98	x1/[1/(1.2)+ 0.04]		=	6.85			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	41.4	14.26	27.14	x	0.18	=	4.89			(29)
Walls Type2	10.58	2.1	8.48	x	0.18	=	1.53			(29)
Total area of elements, m²			51.98							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	25.26	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		13.45	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	38.71	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	68.38	68.38	68.38	68.38	68.38	68.38	68.38	68.38	68.38	68.38	68.38	68.38	

Average = Sum(39)$_{1…12}$ /12= 68.38 (39)

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Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.36 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	99.27	95.66	92.05	88.44	84.83	81.22	81.22	84.83	88.44	92.05	95.66	99.27	

Total = Sum(44)$_{1...12}$ = 1082.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.22	128.76	132.87	115.83	111.15	95.91	88.88	101.99	103.2	120.27	131.29	142.57	

Total = Sum(45)$_{1...12}$ = 1419.93 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.08	19.31	19.93	17.38	16.67	14.39	13.33	15.3	15.48	18.04	19.69	21.39	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.49	178.68	188.14	169.33	166.42	149.4	144.15	157.26	156.7	175.55	184.78	197.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.49	178.68	188.14	169.33	166.42	149.4	144.15	157.26	156.7	175.55	184.78	197.85	

Output from water heater (annual)$_{1...12}$ 2070.77 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.17	82.75	88.4	81.31	81.18	74.69	73.77	78.13	77.11	84.21	86.45	91.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	18.61	16.53	13.44	10.17	7.61	6.42	6.94	9.02	12.1	15.37	17.94	19.12	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	208.54	210.71	205.25	193.64	178.99	165.22	156.01	153.85	159.3	170.91	185.57	199.34	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	(71)
Water heating gains (Table 5)													
(72)m=	125.23	123.15	118.82	112.93	109.11	103.73	99.16	105.02	107.1	113.19	120.07	123.15	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	410.78	408.77	395.91	375.15	354.1	333.76	320.51	326.28	336.9	357.87	381.97	400.02	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	5.98	x	10.63	x	0.5	x	0.8	=	17.63	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.98	x	20.32	x	0.5	x	0.8	=	33.69	(74)

North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.98	x	34.53	x	0.5	x	0.8	=	57.24	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.98	x	55.46	x	0.5	x	0.8	=	91.94	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.98	x	74.72	x	0.5	x	0.8	=	123.85	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.98	x	79.99	x	0.5	x	0.8	=	132.59	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.98	x	74.68	x	0.5	x	0.8	=	123.79	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.98	x	59.25	x	0.5	x	0.8	=	98.21	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.98	x	41.52	x	0.5	x	0.8	=	68.82	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.98	x	24.19	x	0.5	x	0.8	=	40.1	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.98	x	13.12	x	0.5	x	0.8	=	21.74	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	5.98	x	8.86	x	0.5	x	0.8	=	14.69	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)

East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	48.92	94.17	158.48	247.41	324.7	343.55	322.38	261.3	188.65	111.99	60.55	40.62	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	459.7	502.95	554.39	622.56	678.8	677.31	642.89	587.58	525.55	469.86	442.52	440.63	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.83	0.63	0.47	0.53	0.81	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.1	20.21	20.42	20.69	20.9	20.99	21	21	20.94	20.67	20.33	20.07	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.16	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.78	0.55	0.38	0.44	0.74	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.96	19.11	19.41	19.79	20.07	20.15	20.16	20.16	20.11	19.77	19.29	18.91	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.42	19.55	19.81	20.15	20.4	20.48	20.49	20.49	20.44	20.13	19.7	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.42	19.55	19.81	20.15	20.4	20.48	20.49	20.49	20.44	20.13	19.7	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.8	0.58	0.41	0.47	0.76	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	457.83	499.11	543.4	580.29	540.58	395.18	265.47	278.15	401.85	449.88	438.74	439.23	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1033.65	1002.09	910.41	769.47	595	402.26	266.21	279.78	433.58	651.46	861.96	1037.56	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	428.41	338	273.05	136.21	40.49	0	0	0	0	149.97	304.72	445.16	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 2116.02 | (98)

Space heating requirement in kWh/m²/year | 28.24 | (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2116.02	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1666.36	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	555.45	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2070.77	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1630.73	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	543.58	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.96	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		48.49	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	48.49	(331)
Energy for lighting (calculated in Appendix L)		328.59	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4385.17	x	0.22	947.2	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1403.25	x	0.52	-728.29	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4291.4	x	0.22	926.94	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1373.25	x	0.52	-712.72	(366)

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Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	255.26	(368)
Electrical energy for heat distribution	[(313) x	0.52	=	22.82	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	711.21	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			711.21	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	25.17	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	170.54	(379)
Total CO2, kg/year	sum of (376)…(382) =			906.91	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			12.1	(384)
EI rating (section 14)				89.87	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-8-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.94	(1a) x	2.4	(2a) =	179.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.94	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	179.86	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			5.98	x1/[1/(1.4)+ 0.04]		=	7.93			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	41.4	14.26	27.14	x	0.18	=	4.89			(29)
Walls Type2	10.58	2.1	8.48	x	0.18	=	1.53			(29)
Total area of elements, m²			51.98							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	27.42	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		14.01	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	41.42	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.73	35.5	35.27	34.18	33.98	33.04	33.04	32.86	33.4	33.98	34.39	34.82	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	77.15	76.92	76.69	75.61	75.4	74.46	74.46	74.29	74.82	75.4	75.81	76.24

Average = Sum(39)$_{1…12}$ /12= 75.6 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.03	1.03	1.02	1.01	1.01	0.99	0.99	0.99	1	1.01	1.01	1.02

Average = Sum(40)$_{1…12}$ /12= 1.01 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.36 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	99.27	95.66	92.05	88.44	84.83	81.22	81.22	84.83	88.44	92.05	95.66	99.27

Total = Sum(44)$_{1…12}$ = 1082.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.22	128.76	132.87	115.83	111.15	95.91	88.88	101.99	103.2	120.27	131.29	142.57

Total = Sum(45)$_{1…12}$ = 1419.93 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.08	19.31	19.93	17.38	16.67	14.39	13.33	15.3	15.48	18.04	19.69	21.39	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	193.81	170.84	179.46	160.93	157.74	141	135.47	148.58	148.3	166.87	176.38	189.17	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	193.81	170.84	179.46	160.93	157.74	141	135.47	148.58	148.3	166.87	176.38	189.17	

Output from water heater (annual)$_{1...12}$ 1968.55 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.23	76.48	81.45	74.59	74.23	67.96	66.83	71.19	70.39	77.27	79.73	84.68	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.83	16.73	13.6	10.3	7.7	6.5	7.02	9.13	12.25	15.56	18.16	19.36	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	208.54	210.71	205.25	193.64	178.99	165.22	156.01	153.85	159.3	170.91	185.57	199.34	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	(71)

Water heating gains (Table 5)

(72)m=	115.89	113.81	109.48	103.6	99.77	94.39	89.82	95.68	97.76	103.85	110.73	113.82	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	404.67	402.64	389.74	368.94	347.86	327.51	314.26	320.06	330.72	351.72	375.86	393.91	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	5.98	x	10.63	x	0.63	x	0.7	=	19.43	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	5.98	x	20.32	x	0.63	x	0.7	=	37.14	(74)

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North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	5.98	x	34.53	x	0.63	x	0.7	=	63.11	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	5.98	x	55.46	x	0.63	x	0.7	=	101.36	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	5.98	x	74.72	x	0.63	x	0.7	=	136.55	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	5.98	x	79.99	x	0.63	x	0.7	=	146.18	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	5.98	x	74.68	x	0.63	x	0.7	=	136.48	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	5.98	x	59.25	x	0.63	x	0.7	=	108.28	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	5.98	x	41.52	x	0.63	x	0.7	=	75.87	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	5.98	x	24.19	x	0.63	x	0.7	=	44.21	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	5.98	x	13.12	x	0.63	x	0.7	=	23.97	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
North	0.9x	0.77	x	5.98	x	8.86	x	0.63	x	0.7	=	16.2	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)

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East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	53.94	103.83	174.73	272.77	357.98	378.76	355.42	288.08	207.98	123.47	66.76	44.78	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	458.61	506.47	564.46	641.71	705.84	706.27	669.68	608.14	538.7	475.19	442.61	438.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.85	0.65	0.48	0.55	0.83	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.94	20.06	20.29	20.61	20.87	20.98	21	20.99	20.91	20.59	20.21	19.92	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.06	20.06	20.06	20.08	20.08	20.09	20.09	20.09	20.08	20.08	20.07	20.07	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.8	0.57	0.39	0.45	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.64	18.82	19.15	19.62	19.95	20.07	20.09	20.09	20.01	19.59	19.05	18.62	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.16	19.31	19.61	20.02	20.32	20.43	20.45	20.45	20.37	19.99	19.51	19.14	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.16	19.31	19.61	20.02	20.32	20.43	20.45	20.45	20.37	19.99	19.51	19.14	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.81	0.6	0.43	0.49	0.79	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	456.81	502.78	554.01	601.27	572.58	423.34	285.38	297.99	422.98	457.16	439.1	437.34	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1146.14	1108.69	1005.2	840.39	649.64	434.47	286.74	300.82	469.34	708.14	941.18	1138.81	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	512.86	407.17	335.68	172.17	57.33	0	0	0	0	186.72	361.5	521.89	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 2555.33 | (98)

Space heating requirement in kWh/m²/year | 34.1 | (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system | 0 | (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	512.86	407.17	335.68	172.17	57.33	0	0	0	0	186.72	361.5	521.89		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	548.51	435.48	359.02	184.14	61.32	0	0	0	0	199.71	386.63	558.17		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2732.98	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	193.81	170.84	179.46	160.93	157.74	141	135.47	148.58	148.3	166.87	176.38	189.17		
Efficiency of water heater													79.8	(216)
(217)m=	87.29	87.05	86.46	84.99	82.4	79.8	79.8	79.8	79.8	85.11	86.69	87.38		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	222.03	196.26	207.56	189.34	191.44	176.7	169.76	186.19	185.83	196.05	203.47	216.48		
Total = Sum(219a)$_{1...12}$ =													2341.11	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2732.98	
Water heating fuel used			2341.11	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			332.62	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	590.32	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	505.68	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1096	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	172.63	(268)

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Total CO2, kg/year	sum of (265)…(271) =	1307.56	(272)
TER =		17.45	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-8-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	85.47	(1a) x	2.4	(2a) =	205.13	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	85.47	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.13	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			5.06	x1/[1/(1.2)+ 0.04]		=	5.79			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 6			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 7			0.01	x1/[1/(1.2)+ 0.04]		=	0.01			(27)
Walls Type1	50.79	18.87	31.92	x	0.18	=	5.75			(29)
Walls Type2	25.04	2.1	22.94	x	0.18	=	4.13			(29)
Total area of elements, m²			75.83							(31)
Party wall			25.74	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 13.07 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 47.08 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	80.92	80.92	80.92	80.92	80.92	80.92	80.92	80.92	80.92	80.92	80.92	80.92	

Average = Sum(39)1…12 /12= 80.92 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	

Average = Sum(40)1…12 /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.56 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 94.96 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	104.46	100.66	96.86	93.07	89.27	85.47	85.47	89.27	93.07	96.86	100.66	104.46	

Total = Sum(44)1…12 = 1139.57 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	154.91	135.49	139.81	121.89	116.96	100.92	93.52	107.32	108.6	126.56	138.15	150.02	

Total = Sum(45)1…12 = 1494.16 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.24	20.32	20.97	18.28	17.54	15.14	14.03	16.1	16.29	18.98	20.72	22.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.19	185.41	195.09	175.38	172.23	154.42	148.8	162.59	162.09	181.84	191.65	205.3	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	210.19	185.41	195.09	175.38	172.23	154.42	148.8	162.59	162.09	181.84	191.65	205.3

Output from water heater (annual)$_{1...12}$ | 2145 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	95.73	84.99	90.71	83.32	83.11	76.35	75.32	79.9	78.9	86.3	88.73	94.1	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.55	18.25	14.84	11.24	8.4	7.09	7.66	9.96	13.37	16.97	19.81	21.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	230.49	232.88	226.86	214.03	197.83	182.61	172.44	170.04	176.07	188.9	205.1	220.32	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	(71)

Water heating gains (Table 5)

(72)m=	128.67	126.48	121.92	115.73	111.71	106.05	101.23	107.4	109.59	116	123.24	126.48	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	441.09	438.99	425	402.37	379.31	357.12	342.71	348.78	360.41	383.25	409.53	429.3	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	5.06	x	10.63	x	0.5	x	0.8	=	14.91	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.5	x	0.8	=	28.5	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.5	x	0.8	=	48.43	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.5	x	0.8	=	77.8	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.5	x	0.8	=	104.8	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.5	x	0.8	=	112.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.5	x	0.8	=	104.74	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.5	x	0.8	=	83.1	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.5	x	0.8	=	58.23	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.5	x	0.8	=	33.93	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.06	x	13.12	x	0.5	x	0.8	=	18.4	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.5	x	0.8	=	12.43	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
South	0.9x	0.77	x	0.01	x	46.75	x	0.5	x	0.8	=	0.13	(78)
South	0.9x	0.77	x	0.01	x	76.57	x	0.5	x	0.8	=	0.21	(78)
South	0.9x	0.77	x	0.01	x	97.53	x	0.5	x	0.8	=	0.27	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	0.01	x	110.23	x	0.5	x	0.8	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	114.87	x	0.5	x	0.8	=	0.32	(78)
South	0.9x	0.77	x	0.01	x	110.55	x	0.5	x	0.8	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	108.01	x	0.5	x	0.8	=	0.3	(78)
South	0.9x	0.77	x	0.01	x	104.89	x	0.5	x	0.8	=	0.29	(78)
South	0.9x	0.77	x	0.01	x	101.89	x	0.5	x	0.8	=	0.28	(78)
South	0.9x	0.77	x	0.01	x	82.59	x	0.5	x	0.8	=	0.23	(78)
South	0.9x	0.77	x	0.01	x	55.42	x	0.5	x	0.8	=	0.15	(78)
South	0.9x	0.77	x	0.01	x	40.4	x	0.5	x	0.8	=	0.11	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	76.39	147.99	246.77	374.77	479.02	500.6	472.28	391.35	290.94	175.81	94.83	63.18	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	517.48	586.98	671.76	777.14	858.33	857.72	814.99	740.13	651.35	559.06	504.36	492.48	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.79	0.59	0.44	0.5	0.78	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.05	20.18	20.42	20.71	20.92	20.99	21	21	20.94	20.66	20.29	20.01	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.91	0.74	0.52	0.35	0.41	0.71	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.85	19.04	19.38	19.79	20.05	20.12	20.13	20.13	20.08	19.73	19.2	18.8	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.33	19.5	19.8	20.16	20.4	20.47	20.48	20.47	20.43	20.1	19.64	19.28	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.33	19.5	19.8	20.16	20.4	20.47	20.48	20.47	20.43	20.1	19.64	19.28	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.91	0.76	0.55	0.38	0.44	0.74	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	515.54	582.14	655.38	709.91	651.04	468.16	312.93	328.14	479.3	532.78	500.19	491.08	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1216.15	1181.27	1075.93	911.27	703.89	474.78	313.63	329.71	512.11	768.84	1014.56	1220.38	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	521.26	402.62	312.89	144.98	39.32	0	0	0	0	175.63	370.35	542.6	(98)

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 2509.63 (98)

Space heating requirement in kWh/m²/year 29.36 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2509.63	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1976.33	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	658.78	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2145	
If DHW from community scheme:			
Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1689.19	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	563.06	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	48.87	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		55.31	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	55.31	(331)
Energy for lighting (calculated in Appendix L)		362.89	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	5200.88	x	0.22	1123.39	(363)

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less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1664.28	x	0.52		-863.76	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4445.23	x	0.22		960.17	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1422.47	x	0.52		-738.26	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	283.78	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	25.37	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	790.68	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					790.68	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	28.7	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	188.34	(379)
Total CO2, kg/year	sum of (376)…(382) =					1007.73	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					11.79	(384)
EI rating (section 14)						89.65	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-8-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	85.47	(1a) x	2.4	(2a) =	205.13	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	85.47	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.13	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			5.06	x1/[1/(1.4)+ 0.04]		=	6.71			(27)
Windows Type 5			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 6			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 7			0.01	x1/[1/(1.4)+ 0.04]		=	0.01			(27)
Walls Type1	50.79	18.87	31.92	x	0.18	=	5.75			(29)
Walls Type2	25.04	2.1	22.94	x	0.18	=	4.13			(29)
Total area of elements, m²			75.83							(31)
Party wall			25.74	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 36.99 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.38 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

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Total fabric heat loss (33) + (36) = 49.37 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.09	39.85	39.61	38.49	38.28	37.31	37.31	37.13	37.69	38.28	38.71	39.15	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	89.46	89.22	88.98	87.86	87.65	86.68	86.68	86.5	87.06	87.65	88.08	88.52	

Average = $Sum(39)_{1...12}$ /12= 87.86 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.05	1.04	1.04	1.03	1.03	1.01	1.01	1.01	1.02	1.03	1.03	1.04	

Average = $Sum(40)_{1...12}$ /12= 1.03 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.56 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 94.96 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	104.46	100.66	96.86	93.07	89.27	85.47	85.47	89.27	93.07	96.86	100.66	104.46	

Total = $Sum(44)_{1...12}$ = 1139.57 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	154.91	135.49	139.81	121.89	116.96	100.92	93.52	107.32	108.6	126.56	138.15	150.02	

Total = $Sum(45)_{1...12}$ = 1494.16 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.24	20.32	20.97	18.28	17.54	15.14	14.03	16.1	16.29	18.98	20.72	22.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.51	177.57	186.41	166.98	163.55	146.02	140.12	153.91	153.69	173.16	183.24	196.62	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.51	177.57	186.41	166.98	163.55	146.02	140.12	153.91	153.69	173.16	183.24	196.62

Output from water heater (annual)$_{1…12}$ — 2042.78 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	88.78	78.72	83.76	76.6	76.16	69.63	68.37	72.96	72.18	79.36	82.01	87.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.55	18.26	14.85	11.24	8.4	7.09	7.66	9.96	13.37	16.98	19.82	21.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	230.49	232.88	226.86	214.03	197.83	182.61	172.44	170.04	176.07	188.9	205.1	220.32	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	(71)

Water heating gains (Table 5)

(72)m=	119.33	117.14	112.58	106.39	102.37	96.71	91.9	98.06	100.25	106.66	113.9	117.15	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	434.76	432.66	418.67	396.04	372.98	350.79	336.38	342.45	354.07	376.92	403.19	422.97	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	5.06	x	10.63	x	0.63	x	0.7	=	16.44	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.63	x	0.7	=	31.42	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.63	x	0.7	=	53.4	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.63	x	0.7	=	85.77	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.63	x	0.7	=	115.54	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.63	x	0.7	=	123.69	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.63	x	0.7	=	115.48	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.63	x	0.7	=	91.62	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.63	x	0.7	=	64.2	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.63	x	0.7	=	37.41	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	5.06	x	13.12	x	0.63	x	0.7	=	20.29	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.63	x	0.7	=	13.71	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
South	0.9x	0.77	x	0.01	x	46.75	x	0.63	x	0.7	=	0.14	(78)
South	0.9x	0.77	x	0.01	x	76.57	x	0.63	x	0.7	=	0.23	(78)
South	0.9x	0.77	x	0.01	x	97.53	x	0.63	x	0.7	=	0.3	(78)

South	0.9x	0.77	x	0.01	x	110.23	x	0.63	x	0.7	=	0.34	(78)
South	0.9x	0.77	x	0.01	x	114.87	x	0.63	x	0.7	=	0.35	(78)
South	0.9x	0.77	x	0.01	x	110.55	x	0.63	x	0.7	=	0.34	(78)
South	0.9x	0.77	x	0.01	x	108.01	x	0.63	x	0.7	=	0.33	(78)
South	0.9x	0.77	x	0.01	x	104.89	x	0.63	x	0.7	=	0.32	(78)
South	0.9x	0.77	x	0.01	x	101.89	x	0.63	x	0.7	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	82.59	x	0.63	x	0.7	=	0.25	(78)
South	0.9x	0.77	x	0.01	x	55.42	x	0.63	x	0.7	=	0.17	(78)
South	0.9x	0.77	x	0.01	x	40.4	x	0.63	x	0.7	=	0.12	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)

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West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	84.22	163.16	272.06	413.19	528.11	551.92	520.69	431.46	320.77	193.83	104.55	69.66	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	518.98	595.82	690.72	809.22	901.09	902.7	857.07	773.91	674.84	570.75	507.75	492.63	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.94	0.8	0.6	0.44	0.51	0.79	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.91	20.05	20.32	20.66	20.9	20.98	21	20.99	20.93	20.6	20.19	19.88	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.04	20.05	20.05	20.06	20.06	20.07	20.07	20.07	20.07	20.06	20.06	20.05	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.91	0.75	0.52	0.35	0.41	0.72	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.58	18.8	19.18	19.66	19.96	20.06	20.07	20.07	20.01	19.6	19.01	18.56	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.11	19.3	19.63	20.06	20.34	20.43	20.44	20.44	20.38	20	19.48	19.09	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.11	19.3	19.63	20.06	20.34	20.43	20.44	20.44	20.38	20	19.48	19.09	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.91	0.76	0.55	0.39	0.45	0.75	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	517.02	590.88	674.06	740.35	688.78	496.33	331.91	347.22	503.4	545.22	503.65	491.21	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1325.11	1284.91	1168.66	980.66	757.04	505.35	332.97	349.51	546.51	823.61	1090.65	1317.7	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	601.22	466.39	367.98	173.02	50.79	0	0	0	0	207.13	422.64	614.91	

Total per year (kWh/year) = Sum(98)1…5,9…12 = | 2904.08 | (98)

Space heating requirement in kWh/m²/year | 33.98 | (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	601.22	466.39	367.98	173.02	50.79	0	0	0	0	207.13	422.64	614.91		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	643.02	498.81	393.56	185.05	54.32	0	0	0	0	221.53	452.03	657.66		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													3105.97	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	201.51	177.57	186.41	166.98	163.55	146.02	140.12	153.91	153.69	173.16	183.24	196.62		
Efficiency of water heater													79.8	(216)
(217)m=	87.55	87.27	86.6	84.91	82.1	79.8	79.8	79.8	79.8	85.29	86.97	87.65		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	230.15	203.47	215.26	196.66	199.21	182.98	175.58	192.87	192.6	203.02	210.69	224.32		
Total = Sum(219a)$_{1...12}$ =													2426.81	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3105.97	
Water heating fuel used			2426.81	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			362.98	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	670.89	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	524.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1195.08	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	188.39	(268)
Total CO2, kg/year		sum of (265)…(271) =		1422.39	(272)

TER =	16.64	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: a1-9-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	89.66	(1a) x	2.4	(2a) =	215.18	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	89.66	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.18	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DRAFT

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			10.01	x1/[1/(1.2)+ 0.04]		=	11.46			(27)
Windows Type 3			4.22	x1/[1/(1.2)+ 0.04]		=	4.83			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	48.26	22.51	25.75	x	0.18	=	4.63			(29)
Walls Type2	18.56	2.1	16.46	x	0.18	=	2.96			(29)
Roof	89.66	0	89.66	x	0.11	=	9.86			(30)
Total area of elements, m²			156.48							(31)
Party wall			29.7	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 45.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 17.26 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 63.01 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.51	35.51	35.51	35.51	35.51	35.51	35.51	35.51	35.51	35.51	35.51	35.51	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	98.52	98.52	98.52	98.52	98.52	98.52	98.52	98.52	98.52	98.52	98.52	98.52	

Average = Sum(39)$_{1…12}$ /12= 98.52 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	

Average = Sum(40)$_{1…12}$ /12= 1.1 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.62 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.45 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	106.09	102.24	98.38	94.52	90.66	86.8	86.8	90.66	94.52	98.38	102.24	106.09	

Total = Sum(44)$_{1…12}$ = 1157.4 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	157.34	137.61	142	123.8	118.79	102.5	94.98	109	110.3	128.54	140.31	152.37	

Total = Sum(45)$_{1…12}$ = 1517.53 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.6	20.64	21.3	18.57	17.82	15.38	14.25	16.35	16.54	19.28	21.05	22.86	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	212.61	187.53	197.27	177.29	174.06	156	150.26	164.27	163.79	183.82	193.81	207.65	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	212.61	187.53	197.27	177.29	174.06	156	150.26	164.27	163.79	183.82	193.81	207.65

Output from water heater (annual)$_{1...12}$ — 2168.37 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	96.54	85.7	91.44	83.96	83.72	76.88	75.8	80.46	79.47	86.96	89.45	94.88	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.26	18.88	15.36	11.62	8.69	7.34	7.93	10.3	13.83	17.56	20.5	21.85	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	238.45	240.93	234.69	221.42	204.66	188.91	178.39	175.92	182.15	195.42	212.18	227.93	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	(71)

Water heating gains (Table 5)

(72)m=	129.75	127.52	122.9	116.61	112.52	106.77	101.89	108.15	110.37	116.88	124.23	127.53	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	451.78	449.65	435.26	411.96	388.19	365.34	350.52	356.68	368.67	392.18	419.23	439.63	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	10.01	x	10.63	x	0.5	x	0.8	=	29.51	(74)
North	0.9x	0.77	x	10.01	x	20.32	x	0.5	x	0.8	=	56.39	(74)
North	0.9x	0.77	x	10.01	x	34.53	x	0.5	x	0.8	=	95.81	(74)
North	0.9x	0.77	x	10.01	x	55.46	x	0.5	x	0.8	=	153.9	(74)
North	0.9x	0.77	x	10.01	x	74.72	x	0.5	x	0.8	=	207.32	(74)
North	0.9x	0.77	x	10.01	x	79.99	x	0.5	x	0.8	=	221.94	(74)
North	0.9x	0.77	x	10.01	x	74.68	x	0.5	x	0.8	=	207.21	(74)
North	0.9x	0.77	x	10.01	x	59.25	x	0.5	x	0.8	=	164.4	(74)
North	0.9x	0.77	x	10.01	x	41.52	x	0.5	x	0.8	=	115.2	(74)
North	0.9x	0.77	x	10.01	x	24.19	x	0.5	x	0.8	=	67.12	(74)
North	0.9x	0.77	x	10.01	x	13.12	x	0.5	x	0.8	=	36.4	(74)
North	0.9x	0.77	x	10.01	x	8.86	x	0.5	x	0.8	=	24.6	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	4.22	x	19.64	x	0.5	x	0.8	=	22.97	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	4.22	x	38.42	x	0.5	x	0.8	=	44.94	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	4.22	x	63.27	x	0.5	x	0.8	=	74.02	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	4.22	x	92.28	x	0.5	x	0.8	=	107.95	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	4.22	x	113.09	x	0.5	x	0.8	=	132.29	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	4.22	x	115.77	x	0.5	x	0.8	=	135.43	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	4.22	x	110.22	x	0.5	x	0.8	=	128.93	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)

East	0.9x	1	x	4.22	x	94.68	x	0.5	x	0.8	=	110.75	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	4.22	x	73.59	x	0.5	x	0.8	=	86.08	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	4.22	x	45.59	x	0.5	x	0.8	=	53.33	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	4.22	x	24.49	x	0.5	x	0.8	=	28.65	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	4.22	x	16.15	x	0.5	x	0.8	=	18.89	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	97.56	189.51	315.06	473.65	599.19	623.09	589.12	492.45	370.19	225.09	121.25	80.56	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	549.34	639.16	750.31	885.62	987.37	988.42	939.64	849.13	738.86	617.27	540.48	520.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.81	0.61	0.46	0.52	0.8	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.84	20	20.27	20.62	20.87	20.98	21	20.99	20.91	20.55	20.12	19.8	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20	20	20	20	20	20	20	20	20	20	20	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.91	0.75	0.53	0.36	0.42	0.72	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.45	18.68	19.08	19.56	19.88	19.99	20	20	19.93	19.48	18.86	18.39	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.01	19.21	19.55	19.98	20.28	20.38	20.4	20.4	20.32	19.91	19.37	18.96	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.01	19.21	19.55	19.98	20.28	20.38	20.4	20.4	20.32	19.91	19.37	18.96	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.91	0.77	0.56	0.4	0.46	0.75	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	547.16	633.46	730.8	808.43	757.85	555.53	372.35	389.77	555.52	589.26	535.95	518.61	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1449.07	1409.44	1286.08	1091.83	845.22	569.63	374.21	393.64	612.94	917.1	1208.54	1453.78	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	671.02	521.46	413.14	204.05	65	0	0	0	0	243.91	484.27	695.77	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3298.61 (98)

Space heating requirement in kWh/m²/year 36.79 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		3298.61	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	2597.66	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	865.89	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2168.37	
If DHW from community scheme:			
Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1707.59	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	569.2	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	57.4	(313)

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Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		58.02	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	58.02	(331)
Energy for lighting (calculated in Appendix L)		375.42	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
Space heating from CHP)	(307a) × 100 ÷ (362) =	6835.95	x	0.22		1476.56	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	2187.5	x	0.52		-1135.31	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4493.66	x	0.22		970.63	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1437.97	x	0.52		-746.31	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	333.31	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	29.79	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	928.68	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					928.68	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	30.11	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	194.85	(379)
Total CO2, kg/year	sum of (376)…(382) =					1153.63	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					12.87	(384)
EI rating (section 14)						88.52	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-9-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	89.66	(1a) x	2.4	(2a) =	215.18	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	89.66	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.18	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.39	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.41	0.41	0.36	0.36	0.31	0.31	0.31	0.33	0.36	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.49	x1/[1/(1.4)+ 0.04]		=	3.3			(27)
Windows Type 2			9.03	x1/[1/(1.4)+ 0.04]		=	11.97			(27)
Windows Type 3			3.81	x1/[1/(1.4)+ 0.04]		=	5.05			(27)
Windows Type 4			2.49	x1/[1/(1.4)+ 0.04]		=	3.3			(27)
Windows Type 5			2.49	x1/[1/(1.4)+ 0.04]		=	3.3			(27)
Walls Type1	48.26	20.31	27.95	x	0.18	=	5.03			(29)
Walls Type2	18.56	2.1	16.46	x	0.18	=	2.96			(29)
Roof	89.66	0	89.66	x	0.13	=	11.66			(30)
Total area of elements, m²			156.48							(31)
Party wall			29.7	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 48.68 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 18.33 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 67 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.83	41.58	41.34	40.21	40	39.02	39.02	38.83	39.4	40	40.43	40.88	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	108.83	108.59	108.34	107.21	107	106.02	106.02	105.84	106.4	107	107.43	107.88	

Average = Sum(39)$_{1…12}$ /12= 107.21 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.21	1.21	1.21	1.2	1.19	1.18	1.18	1.18	1.19	1.19	1.2	1.2	

Average = Sum(40)$_{1…12}$ /12= 1.2 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.62 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.45 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	106.09	102.24	98.38	94.52	90.66	86.8	86.8	90.66	94.52	98.38	102.24	106.09	

Total = Sum(44)$_{1…12}$ = 1157.4 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	157.34	137.61	142	123.8	118.79	102.5	94.98	109	110.3	128.54	140.31	152.37	

Total = Sum(45)$_{1…12}$ = 1517.53 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.6	20.64	21.3	18.57	17.82	15.38	14.25	16.35	16.54	19.28	21.05	22.86	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	203.93	179.69	188.59	168.89	165.38	147.6	141.58	155.59	155.39	175.14	185.4	198.97	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	203.93	179.69	188.59	168.89	165.38	147.6	141.58	155.59	155.39	175.14	185.4	198.97

Output from water heater (annual)$_{1...12}$ — 2066.15 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.59	79.42	84.49	77.24	76.77	70.16	68.86	73.52	72.75	80.02	82.73	87.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.25	18.88	15.35	11.62	8.69	7.33	7.93	10.3	13.83	17.56	20.49	21.84	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	238.45	240.93	234.69	221.42	204.66	188.91	178.39	175.92	182.15	195.42	212.18	227.93	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	(71)

Water heating gains (Table 5)

(72)m=	120.42	118.19	113.56	107.27	103.19	97.44	92.55	98.81	101.04	107.55	114.9	118.2	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	445.44	443.31	428.92	405.63	381.85	359	344.18	350.35	362.33	385.85	412.89	433.29	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	9.03	x	10.63	x	0.63	x	0.7	=	29.34	(74)
North	0.9x	0.77	x	9.03	x	20.32	x	0.63	x	0.7	=	56.08	(74)
North	0.9x	0.77	x	9.03	x	34.53	x	0.63	x	0.7	=	95.29	(74)
North	0.9x	0.77	x	9.03	x	55.46	x	0.63	x	0.7	=	153.06	(74)
North	0.9x	0.77	x	9.03	x	74.72	x	0.63	x	0.7	=	206.19	(74)
North	0.9x	0.77	x	9.03	x	79.99	x	0.63	x	0.7	=	220.73	(74)
North	0.9x	0.77	x	9.03	x	74.68	x	0.63	x	0.7	=	206.08	(74)
North	0.9x	0.77	x	9.03	x	59.25	x	0.63	x	0.7	=	163.5	(74)
North	0.9x	0.77	x	9.03	x	41.52	x	0.63	x	0.7	=	114.57	(74)
North	0.9x	0.77	x	9.03	x	24.19	x	0.63	x	0.7	=	66.76	(74)
North	0.9x	0.77	x	9.03	x	13.12	x	0.63	x	0.7	=	36.2	(74)
North	0.9x	0.77	x	9.03	x	8.86	x	0.63	x	0.7	=	24.46	(74)
East	0.9x	1	x	2.49	x	19.64	x	0.63	x	0.7	=	14.95	(76)
East	0.9x	1	x	3.81	x	19.64	x	0.63	x	0.7	=	22.87	(76)
East	0.9x	1	x	2.49	x	19.64	x	0.63	x	0.7	=	14.95	(76)
East	0.9x	1	x	2.49	x	19.64	x	0.63	x	0.7	=	14.95	(76)
East	0.9x	1	x	2.49	x	38.42	x	0.63	x	0.7	=	29.24	(76)
East	0.9x	1	x	3.81	x	38.42	x	0.63	x	0.7	=	44.74	(76)
East	0.9x	1	x	2.49	x	38.42	x	0.63	x	0.7	=	29.24	(76)
East	0.9x	1	x	2.49	x	38.42	x	0.63	x	0.7	=	29.24	(76)
East	0.9x	1	x	2.49	x	63.27	x	0.63	x	0.7	=	48.15	(76)
East	0.9x	1	x	3.81	x	63.27	x	0.63	x	0.7	=	73.67	(76)
East	0.9x	1	x	2.49	x	63.27	x	0.63	x	0.7	=	48.15	(76)
East	0.9x	1	x	2.49	x	63.27	x	0.63	x	0.7	=	48.15	(76)
East	0.9x	1	x	2.49	x	92.28	x	0.63	x	0.7	=	70.22	(76)
East	0.9x	1	x	3.81	x	92.28	x	0.63	x	0.7	=	107.45	(76)
East	0.9x	1	x	2.49	x	92.28	x	0.63	x	0.7	=	70.22	(76)
East	0.9x	1	x	2.49	x	92.28	x	0.63	x	0.7	=	70.22	(76)
East	0.9x	1	x	2.49	x	113.09	x	0.63	x	0.7	=	86.06	(76)
East	0.9x	1	x	3.81	x	113.09	x	0.63	x	0.7	=	131.68	(76)
East	0.9x	1	x	2.49	x	113.09	x	0.63	x	0.7	=	86.06	(76)
East	0.9x	1	x	2.49	x	113.09	x	0.63	x	0.7	=	86.06	(76)
East	0.9x	1	x	2.49	x	115.77	x	0.63	x	0.7	=	88.1	(76)
East	0.9x	1	x	3.81	x	115.77	x	0.63	x	0.7	=	134.8	(76)
East	0.9x	1	x	2.49	x	115.77	x	0.63	x	0.7	=	88.1	(76)
East	0.9x	1	x	2.49	x	115.77	x	0.63	x	0.7	=	88.1	(76)
East	0.9x	1	x	2.49	x	110.22	x	0.63	x	0.7	=	83.87	(76)
East	0.9x	1	x	3.81	x	110.22	x	0.63	x	0.7	=	128.34	(76)
East	0.9x	1	x	2.49	x	110.22	x	0.63	x	0.7	=	83.87	(76)
East	0.9x	1	x	2.49	x	110.22	x	0.63	x	0.7	=	83.87	(76)
East	0.9x	1	x	2.49	x	94.68	x	0.63	x	0.7	=	72.05	(76)

East	0.9x	1	x	3.81	x	94.68	x	0.63	x	0.7	=	110.24	(76)
East	0.9x	1	x	2.49	x	94.68	x	0.63	x	0.7	=	72.05	(76)
East	0.9x	1	x	2.49	x	94.68	x	0.63	x	0.7	=	72.05	(76)
East	0.9x	1	x	2.49	x	73.59	x	0.63	x	0.7	=	56	(76)
East	0.9x	1	x	3.81	x	73.59	x	0.63	x	0.7	=	85.69	(76)
East	0.9x	1	x	2.49	x	73.59	x	0.63	x	0.7	=	56	(76)
East	0.9x	1	x	2.49	x	73.59	x	0.63	x	0.7	=	56	(76)
East	0.9x	1	x	2.49	x	45.59	x	0.63	x	0.7	=	34.69	(76)
East	0.9x	1	x	3.81	x	45.59	x	0.63	x	0.7	=	53.08	(76)
East	0.9x	1	x	2.49	x	45.59	x	0.63	x	0.7	=	34.69	(76)
East	0.9x	1	x	2.49	x	45.59	x	0.63	x	0.7	=	34.69	(76)
East	0.9x	1	x	2.49	x	24.49	x	0.63	x	0.7	=	18.64	(76)
East	0.9x	1	x	3.81	x	24.49	x	0.63	x	0.7	=	28.51	(76)
East	0.9x	1	x	2.49	x	24.49	x	0.63	x	0.7	=	18.64	(76)
East	0.9x	1	x	2.49	x	24.49	x	0.63	x	0.7	=	18.64	(76)
East	0.9x	1	x	2.49	x	16.15	x	0.63	x	0.7	=	12.29	(76)
East	0.9x	1	x	3.81	x	16.15	x	0.63	x	0.7	=	18.81	(76)
East	0.9x	1	x	2.49	x	16.15	x	0.63	x	0.7	=	12.29	(76)
East	0.9x	1	x	2.49	x	16.15	x	0.63	x	0.7	=	12.29	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	97.05	188.53	313.42	471.18	596.06	619.83	586.04	489.88	368.26	223.92	120.62	80.14	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	542.49	631.83	742.33	876.81	977.91	978.83	930.22	840.22	730.59	609.76	533.51	513.43	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.84	0.65	0.49	0.56	0.83	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.68	19.84	20.13	20.51	20.82	20.96	20.99	20.98	20.87	20.46	20	19.65	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.91	19.91	19.91	19.92	19.93	19.93	19.93	19.94	19.93	19.93	19.92	19.92	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.78	0.56	0.38	0.44	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.15	18.39	18.81	19.36	19.75	19.91	19.93	19.93	19.83	19.3	18.63	18.12	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.76	18.97	19.34	19.82	20.18	20.33	20.36	20.35	20.24	19.76	19.18	18.73	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.76	18.97	19.34	19.82	20.18	20.33	20.36	20.35	20.24	19.76	19.18	18.73	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.92	0.8	0.6	0.42	0.49	0.78	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	540.38	626.56	725.24	810.97	779.68	583.89	394.6	411.35	570.8	585.58	529.32	511.89	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1574.05	1527.84	1391.07	1171.09	907.12	607.36	398.13	418.23	653.7	980.63	1297.78	1567.72	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	769.05	605.66	495.38	259.29	94.82	0	0	0	0	293.92	553.29	785.54	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3856.94 (98)

Space heating requirement in kWh/m²/year 43.02 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	769.05	605.66	495.38	259.29	94.82	0	0	0	0	293.92	553.29	785.54		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	822.52	647.76	529.82	277.31	101.41	0	0	0	0	314.35	591.75	840.15		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													4125.07	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	203.93	179.69	188.59	168.89	165.38	147.6	141.58	155.59	155.39	175.14	185.4	198.97		
Efficiency of water heater													79.8	(216)
(217)m=	88.03	87.81	87.27	85.95	83.39	79.8	79.8	79.8	79.8	86.19	87.55	88.11		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	231.67	204.65	216.09	196.49	198.32	184.96	177.42	194.98	194.72	203.21	211.76	225.81		
Total = Sum(219a)$_{1...12}$ =													2440.07	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		4125.07

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Water heating fuel used			2440.07	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			375.35	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	891.01	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	527.05	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1418.07	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	194.81	(268)
Total CO2, kg/year		sum of (265)…(271) =		1651.8	(272)

TER = 18.42 (273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-9-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.39	(1a) x	2.4	(2a) =	171.34	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.39	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		171.34	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.06	x1/[1/(1.2)+ 0.04]		=	5.79			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	40.85	13.34	27.51	x	0.18	=	4.95			(29)
Walls Type2	12.13	2.1	10.03	x	0.18	=	1.81			(29)
Roof	71.39	0	71.39	x	0.11	=	7.85			(30)
Total area of elements, m²			124.37							(31)
Party wall			28.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 13.99 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 46.39 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	28.27	28.27	28.27	28.27	28.27	28.27	28.27	28.27	28.27	28.27	28.27	28.27	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	74.66	74.66	74.66	74.66	74.66	74.66	74.66	74.66	74.66	74.66	74.66	74.66	

Average = Sum(39)$_{1…12}$ /12= 74.66 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	

Average = Sum(40)$_{1…12}$ /12= 1.05 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.28 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	97.17	93.64	90.1	86.57	83.04	79.5	79.5	83.04	86.57	90.1	93.64	97.17	

Total = Sum(44)$_{1…12}$ = 1060.03 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.1	126.03	130.05	113.38	108.79	93.88	86.99	99.83	101.02	117.73	128.51	139.55	

Total = Sum(45)$_{1…12}$ = 1389.86 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.61	18.9	19.51	17.01	16.32	14.08	13.05	14.97	15.15	17.66	19.28	20.93	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.38	175.96	185.33	166.88	164.07	147.37	142.27	155.1	154.51	173	182	194.83	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.38	175.96	185.33	166.88	164.07	147.37	142.27	155.1	154.51	173	182	194.83

Output from water heater (annual)$_{1\ldots12}$ | 2040.7 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.13	81.85	87.46	80.49	80.4	74.01	73.15	77.41	76.38	83.37	85.52	90.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.91	15.9	12.93	9.79	7.32	6.18	6.68	8.68	11.65	14.79	17.26	18.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.52	202.6	197.36	186.19	172.1	158.86	150.01	147.93	153.17	164.34	178.43	191.67	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	(71)

Water heating gains (Table 5)

(72)m=	123.84	121.8	117.56	111.8	108.06	102.79	98.32	104.05	106.09	112.05	118.78	121.8	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	399.45	397.49	385.04	364.97	344.67	325.02	312.2	317.85	328.1	348.37	371.67	389.07	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.06	x	19.64	x	0.5	x	0.8	=	27.55	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)

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East	0.9x	1	x	5.06	x	38.42	x	0.5	x	0.8	=	53.89	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	5.06	x	63.27	x	0.5	x	0.8	=	88.75	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	5.06	x	92.28	x	0.5	x	0.8	=	129.44	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	5.06	x	113.09	x	0.5	x	0.8	=	158.63	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	5.06	x	115.77	x	0.5	x	0.8	=	162.38	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	5.06	x	110.22	x	0.5	x	0.8	=	154.6	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	5.06	x	94.68	x	0.5	x	0.8	=	132.8	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	5.06	x	73.59	x	0.5	x	0.8	=	103.22	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	5.06	x	45.59	x	0.5	x	0.8	=	63.94	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	5.06	x	24.49	x	0.5	x	0.8	=	34.35	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	5.06	x	16.15	x	0.5	x	0.8	=	22.65	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)

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South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	114.11	200.44	286.4	368.71	420.92	420.11	404.19	365.73	315.42	225.19	137.88	96.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	513.56	597.94	671.44	733.69	765.59	745.13	716.39	683.59	643.52	573.56	509.55	485.9	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.92	0.8	0.62	0.45	0.5	0.74	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.01	20.18	20.42	20.69	20.89	20.98	21	20.99	20.95	20.68	20.28	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.89	0.75	0.54	0.36	0.4	0.66	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.74	18.98	19.33	19.7	19.94	20.03	20.04	20.04	20.01	19.69	19.13	18.67	(90)

fLA = Living area ÷ (4) = 0.4 (91)

DRAFT

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.25	19.46	19.76	20.09	20.32	20.41	20.43	20.42	20.38	20.09	19.59	19.19	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.25	19.46	19.76	20.09	20.32	20.41	20.43	20.42	20.38	20.09	19.59	19.19	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.89	0.76	0.57	0.4	0.44	0.69	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	509.43	587.21	642.85	655.77	584.23	423.87	284.42	298.47	442.72	526.83	500.68	482.91	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1116.1	1087.16	990.35	835.82	643.78	433.8	285.59	300.42	469.01	708.49	932.8	1119.18	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	451.37	335.96	258.55	129.64	44.31	0	0	0	0	135.15	311.12	473.39	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2139.48 (98)

Space heating requirement in kWh/m²/year 29.97 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2139.48	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1684.84	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	561.61	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2040.7	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1607.05	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	535.68	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.89	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.2	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	46.2	(331)
Energy for lighting (calculated in Appendix L)		316.23	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4433.79	x	0.22	957.7	(363)

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less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1418.81	x	0.52		-736.36	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4229.09	x	0.22		913.48	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1353.31	x	0.52		-702.37	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	254.86	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	22.78	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	710.09	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					710.09	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	23.98	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	164.12	(379)
Total CO2, kg/year	sum of (376)…(382) =					898.19	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					12.58	(384)
EI rating (section 14)						89.66	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: a1-9-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.39	(1a) x	2.4	(2a) =	171.34	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.34	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.43	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.06	x1/[1/(1.4)+ 0.04]		=	6.71			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	40.85	13.34	27.51	x	0.18	=	4.95			(29)
Walls Type2	12.13	2.1	10.03	x	0.18	=	1.81			(29)
Roof	71.39	0	71.39	x	0.13	=	9.28			(30)
Total area of elements, m²			124.37							(31)
Party wall			28.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.82 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.9 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 50.72 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	34.27	34.04	33.81	32.74	32.54	31.6	31.6	31.43	31.96	32.54	32.94	33.37	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	84.99	84.76	84.53	83.46	83.26	82.32	82.32	82.15	82.68	83.26	83.66	84.09	

Average = Sum(39)$_{1…12}$ /12= 83.46 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.19	1.19	1.18	1.17	1.17	1.15	1.15	1.15	1.16	1.17	1.17	1.18	

Average = Sum(40)$_{1…12}$ /12= 1.17 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.28 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.17	93.64	90.1	86.57	83.04	79.5	79.5	83.04	86.57	90.1	93.64	97.17	

Total = Sum(44)$_{1…12}$ = 1060.03 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.1	126.03	130.05	113.38	108.79	93.88	86.99	99.83	101.02	117.73	128.51	139.55	

Total = Sum(45)$_{1…12}$ = 1389.86 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.61	18.9	19.51	17.01	16.32	14.08	13.05	14.97	15.15	17.66	19.28	20.93	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	190.69	168.12	176.65	158.47	155.39	138.97	133.59	146.42	146.11	164.32	173.6	186.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	190.69	168.12	176.65	158.47	155.39	138.97	133.59	146.42	146.11	164.32	173.6	186.15	

Output from water heater (annual)$_{1...12}$ | 1938.48 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.19	75.57	80.52	73.77	73.45	67.29	66.2	70.47	69.66	76.42	78.8	83.68	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.16	16.13	13.11	9.93	7.42	6.27	6.77	8.8	11.81	15	17.5	18.66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.52	202.6	197.36	186.19	172.1	158.86	150.01	147.93	153.17	164.34	178.43	191.67	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	(71)

Water heating gains (Table 5)

(72)m=	114.5	112.46	108.22	102.46	98.72	93.46	88.98	94.72	96.75	102.72	109.45	112.47	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	393.37	391.38	378.88	358.78	338.44	318.77	305.95	311.64	321.93	342.24	365.57	382.99	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.06	x	19.64	x	0.63	x	0.7	=	30.37	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)

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East	0.9x	1	x	5.06	x	38.42	x	0.63	x	0.7	=	59.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	5.06	x	63.27	x	0.63	x	0.7	=	97.85	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	5.06	x	92.28	x	0.63	x	0.7	=	142.7	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	5.06	x	113.09	x	0.63	x	0.7	=	174.89	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	5.06	x	115.77	x	0.63	x	0.7	=	179.03	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	5.06	x	110.22	x	0.63	x	0.7	=	170.44	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	5.06	x	94.68	x	0.63	x	0.7	=	146.41	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	5.06	x	73.59	x	0.63	x	0.7	=	113.8	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	5.06	x	45.59	x	0.63	x	0.7	=	70.5	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	5.06	x	24.49	x	0.63	x	0.7	=	37.87	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	5.06	x	16.15	x	0.63	x	0.7	=	24.98	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)

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South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	125.81	220.99	315.75	406.5	464.07	463.17	445.62	403.22	347.75	248.27	152.01	106.75	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	519.17	612.37	694.64	765.28	802.5	781.94	751.58	714.86	669.68	590.51	517.59	489.74	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.92	0.82	0.64	0.48	0.52	0.76	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.82	20.01	20.28	20.6	20.84	20.97	20.99	20.99	20.92	20.6	20.15	19.79	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.93	19.93	19.94	19.95	19.96	19.96	19.96	19.95	19.95	19.94	19.94	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.9	0.76	0.55	0.37	0.41	0.68	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.37	18.65	19.04	19.5	19.8	19.94	19.96	19.96	19.89	19.5	18.86	18.34	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.95	19.19	19.54	19.94	20.22	20.35	20.37	20.37	20.3	19.94	19.37	18.92	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.95	19.19	19.54	19.94	20.22	20.35	20.37	20.37	20.3	19.94	19.37	18.92	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.9	0.78	0.58	0.41	0.45	0.71	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	514.95	601.46	666.13	688.12	623.76	457.37	308.25	322.64	473.28	545.65	508.8	486.67	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1245.39	1211.35	1101.96	921.32	709.3	473.19	310.42	326.11	512.99	777.59	1026.97	1237.54	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	543.45	409.84	324.25	167.91	63.64	0	0	0	0	172.56	373.08	558.65	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 2613.38 (98)

Space heating requirement in kWh/m²/year 36.61 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	543.45	409.84	324.25	167.91	63.64	0	0	0	0	172.56	373.08	558.65		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	581.23	438.33	346.79	179.58	68.06	0	0	0	0	184.56	399.02	597.48		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2795.06	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	190.69	168.12	176.65	158.47	155.39	138.97	133.59	146.42	146.11	164.32	173.6	186.15		
Efficiency of water heater													79.8	(216)
(217)m=	87.45	87.1	86.41	84.97	82.64	79.8	79.8	79.8	79.8	84.94	86.8	87.57		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	218.05	193.01	204.42	186.51	188.03	174.15	167.4	183.49	183.1	193.45	199.99	212.58		
Total = Sum(219a)$_{1...12}$ =													2304.17	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2795.06	
Water heating fuel used			2304.17	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			320.62	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	603.73	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	497.7	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1101.43	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	166.4	(268)
Total CO2, kg/year		sum of (265)…(271) =		1306.76	(272)

TER =	18.3	(273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-9-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.1	(1a) x	2.4	(2a) =	177.84	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.1	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	177.84	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.98	x1/[1/(1.2)+ 0.04]		=	6.85			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	47.4	16.1	31.3	x	0.18	=	5.63			(29)
Walls Type2	26.78	2.1	24.68	x	0.18	=	4.44			(29)
Roof	74.1	0	74.1	x	0.11	=	8.15			(30)
Total area of elements, m²			148.28							(31)
Party wall			20.62	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	39.18	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		15.12	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	54.31	(37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	83.65	83.65	83.65	83.65	83.65	83.65	83.65	83.65	83.65	83.65	83.65	83.65	

Average = Sum(39)$_{1...12}$ /12= 83.65 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	

Average = Sum(40)$_{1...12}$ /12= 1.13 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.34 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.81 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	98.79	95.2	91.6	88.01	84.42	80.83	80.83	84.42	88.01	91.6	95.2	98.79	

Total = Sum(44)$_{1...12}$ = 1077.7 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.5	128.13	132.22	115.27	110.61	95.45	88.44	101.49	102.7	119.69	130.65	141.88	

Total = Sum(45)$_{1...12}$ = 1413.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.98	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.41	17.95	19.6	21.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.78	178.06	187.5	168.77	165.88	148.94	143.72	156.77	156.2	174.97	184.15	197.16	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.78	178.06	187.5	168.77	165.88	148.94	143.72	156.77	156.2	174.97	184.15	197.16

Output from water heater (annual)1…12 | 2063.88 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.93	82.55	88.18	81.12	81	74.53	73.63	77.97	76.94	84.02	86.24	91.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.42	16.36	13.31	10.08	7.53	6.36	6.87	8.93	11.99	15.22	17.76	18.94	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	206.67	208.82	203.41	191.91	177.38	163.73	154.61	152.47	157.87	169.38	183.9	197.55	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	(71)

Water heating gains (Table 5)

(72)m=	124.91	122.84	118.53	112.67	108.87	103.51	98.96	104.79	106.87	112.93	119.77	122.84	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	408.13	406.14	393.37	372.77	351.9	331.73	318.57	324.32	334.85	355.65	379.56	397.45	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

South	0.9x	0.77	x	5.98	x	46.75	x	0.5	x	0.8	=	77.5	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	5.98	x	76.57	x	0.5	x	0.8	=	126.92	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	5.98	x	97.53	x	0.5	x	0.8	=	161.68	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	5.98	x	110.23	x	0.5	x	0.8	=	182.73	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	5.98	x	114.87	x	0.5	x	0.8	=	190.42	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	5.98	x	110.55	x	0.5	x	0.8	=	183.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	5.98	x	108.01	x	0.5	x	0.8	=	179.05	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	5.98	x	104.89	x	0.5	x	0.8	=	173.88	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	5.98	x	101.89	x	0.5	x	0.8	=	168.89	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	5.98	x	82.59	x	0.5	x	0.8	=	136.9	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	5.98	x	55.42	x	0.5	x	0.8	=	91.86	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	5.98	x	40.4	x	0.5	x	0.8	=	66.97	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)

West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	153.34	263.89	365.39	455.34	509.03	504.02	486.55	447.29	396.98	293.09	184.22	130.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	561.47	670.03	758.76	828.11	860.94	835.75	805.12	771.6	731.83	648.74	563.78	528.28	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.91	0.79	0.62	0.45	0.49	0.72	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.13	20.39	20.67	20.88	20.97	21	20.99	20.94	20.66	20.23	19.88	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.88	0.73	0.53	0.35	0.39	0.64	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.57	18.85	19.22	19.61	19.86	19.96	19.98	19.97	19.93	19.61	19	18.5	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.12	19.36	19.69	20.03	20.27	20.37	20.38	20.38	20.34	20.03	19.49	19.05	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.12	19.36	19.69	20.03	20.27	20.37	20.38	20.38	20.34	20.03	19.49	19.05	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.88	0.75	0.56	0.39	0.43	0.67	0.91	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	556.01	654.94	719.67	729.53	646.78	469.49	314.84	330.46	491.15	587.74	551.99	524.39	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1239.38	1209.73	1103.23	931.17	716.81	482.28	316.49	333.08	521.66	788.83	1036.63	1242.25	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	508.42	372.82	285.37	145.18	52.1	0	0	0	0	149.61	348.94	534.09	

Total per year (kWh/year) = $\text{Sum}(98)_{1...5,9...12}$ = 2396.54 (98)

Space heating requirement in kWh/m²/year 32.34 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2396.54	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1887.27	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	629.09	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		2063.88	
If DHW from community scheme:			
Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1625.3	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	541.77	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	46.83	(313)

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Cooling System Energy Efficiency Ratio				0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =			0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside				47.95	(330a)
warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			47.95	(331)
Energy for lighting (calculated in Appendix L)				325.39	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit					32	(361)
Heat efficiency of CHP unit					38	(362)
		Energy kWh/year	**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4966.51 x	0.22		1072.77	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1589.28 x	0.52		-824.84	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4277.12 x	0.22		923.86	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1368.68 x	0.52		-710.34	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	271.94	(368)
Electrical energy for heat distribution	[(313) x		0.52	=	24.31	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	757.69	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				757.69	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	24.89	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	168.88	(379)
Total CO2, kg/year	sum of (376)…(382) =				951.45	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				12.84	(384)
EI rating (section 14)					89.3	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: a1-9-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.1	(1a) x	2.4	(2a) =	177.84	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.1	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	177.84	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.98	x1/[1/(1.4)+ 0.04]		=	7.93			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 5			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	47.4	16.1	31.3	x	0.18	=	5.63			(29)
Walls Type2	26.78	2.1	24.68	x	0.18	=	4.44			(29)
Roof	74.1	0	74.1	x	0.13	=	9.63			(30)
Total area of elements, m²			148.28							(31)
Party wall			20.62	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 43.15 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 17.19 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 60.34 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.39	35.15	34.92	33.84	33.64	32.7	32.7	32.52	33.06	33.64	34.05	34.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	95.73	95.49	95.26	94.18	93.98	93.04	93.04	92.87	93.4	93.98	94.39	94.82	

Average = Sum(39)$_{1…12}$ /12= 94.18 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.29	1.29	1.29	1.27	1.27	1.26	1.26	1.25	1.26	1.27	1.27	1.28	

Average = Sum(40)$_{1…12}$ /12= 1.27 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.34 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.81 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

DRAFT

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	98.79	95.2	91.6	88.01	84.42	80.83	80.83	84.42	88.01	91.6	95.2	98.79

Total = Sum(44)$_{1…12}$ = 1077.7 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.5	128.13	132.22	115.27	110.61	95.45	88.44	101.49	102.7	119.69	130.65	141.88

Total = Sum(45)$_{1…12}$ = 1413.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.98	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.41	17.95	19.6	21.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	193.1	170.22	178.82	160.36	157.2	140.54	135.04	148.09	147.8	166.29	175.74	188.47	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	193.1	170.22	178.82	160.36	157.2	140.54	135.04	148.09	147.8	166.29	175.74	188.47

Output from water heater (annual)$_{1...12}$ | 1961.66 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.99	76.27	81.24	74.4	74.05	67.81	66.68	71.02	70.22	77.07	79.52	84.45	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.44	16.38	13.32	10.08	7.54	6.36	6.88	8.94	12	15.23	17.78	18.95	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	206.67	208.82	203.41	191.91	177.38	163.73	154.61	152.47	157.87	169.38	183.9	197.55	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	(71)

Water heating gains (Table 5)

(72)m=	115.58	113.5	109.19	103.34	99.53	94.18	89.63	95.46	97.53	103.59	110.44	113.51	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	401.81	399.82	387.04	366.45	345.58	325.4	312.24	317.99	328.52	349.33	373.24	391.13	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

South	0.9x	0.77	x	5.98	x	46.75	x	0.63	x	0.7	=	85.44	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	5.98	x	76.57	x	0.63	x	0.7	=	139.93	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	5.98	x	97.53	x	0.63	x	0.7	=	178.25	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	5.98	x	110.23	x	0.63	x	0.7	=	201.46	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	5.98	x	114.87	x	0.63	x	0.7	=	209.93	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	5.98	x	110.55	x	0.63	x	0.7	=	202.03	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	5.98	x	108.01	x	0.63	x	0.7	=	197.4	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	5.98	x	104.89	x	0.63	x	0.7	=	191.7	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	5.98	x	101.89	x	0.63	x	0.7	=	186.2	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	5.98	x	82.59	x	0.63	x	0.7	=	150.93	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	5.98	x	55.42	x	0.63	x	0.7	=	101.28	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	5.98	x	40.4	x	0.63	x	0.7	=	73.83	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)

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West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	169.05	290.94	402.84	502.01	561.21	555.68	536.42	493.13	437.67	323.14	203.11	144.23	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	570.86	690.75	789.88	868.46	906.78	881.08	848.66	811.12	766.19	672.46	576.35	535.37	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.91	0.81	0.64	0.47	0.51	0.75	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.73	19.94	20.24	20.57	20.82	20.96	20.99	20.99	20.91	20.57	20.08	19.69	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.85	19.85	19.85	19.86	19.87	19.88	19.88	19.88	19.87	19.87	19.86	19.86	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.89	0.75	0.54	0.36	0.39	0.66	0.91	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.18	18.49	18.91	19.39	19.7	19.85	19.87	19.87	19.81	19.4	18.7	18.13	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.8	19.07	19.44	19.86	20.15	20.29	20.32	20.32	20.25	19.87	19.25	18.75	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(93)m=	18.8	19.07	19.44	19.86	20.15	20.29	20.32	20.32	20.25	19.87	19.25	18.75		(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.98	0.95	0.89	0.76	0.58	0.4	0.44	0.69	0.91	0.98	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	565.09	674.98	750	769.23	693.3	509.05	343.05	359.2	527.8	612.5	564.29	531.21		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	1387.86	1353.32	1232.93	1032.23	794.35	529.63	346.13	363.91	574.23	870.8	1147.16	1379.89		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	612.14	455.85	359.3	189.36	75.18	0	0	0	0	192.18	419.67	631.41		
Total per year (kWh/year) = Sum(98)1...5,9...12 =													2935.08	(98)
Space heating requirement in kWh/m²/year													39.61	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	612.14	455.85	359.3	189.36	75.18	0	0	0	0	192.18	419.67	631.41		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	654.7	487.54	384.28	202.52	80.4	0	0	0	0	205.54	448.84	675.31		
Total (kWh/year) =Sum(211)1...5,10...12=													3139.12	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)1...5,10...12=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)														
	193.1	170.22	178.82	160.36	157.2	140.54	135.04	148.09	147.8	166.29	175.74	188.47		
Efficiency of water heater													79.8	(216)
(217)m=	87.68	87.32	86.64	85.26	82.97	79.8	79.8	79.8	79.8	85.2	87.05	87.79		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	220.23	194.94	206.39	188.09	189.46	176.11	169.22	185.57	185.21	195.17	201.88	214.68		
Total = Sum(219a)1...12 =													2326.95	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3139.12

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Water heating fuel used			2326.95	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			325.65	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	678.05	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	502.62	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1180.67	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	169.01	(268)
Total CO2, kg/year		sum of (265)…(271) =		1388.61	(272)

TER = 18.74 (273)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: a1-9-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	92.47	(1a)	x	2.4	(2a)	=	221.93	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.47	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	221.93	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			8.51	x1/[1/(1.2)+ 0.04]		=	9.74			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			4.48	x1/[1/(1.2)+ 0.04]		=	5.13			(27)
Windows Type 4			0.01	x1/[1/(1.2)+ 0.04]		=	0.01			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 6			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 7			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	55.39	24.04	31.35	x	0.18	=	5.64			(29)
Walls Type2	33.78	2.1	31.68	x	0.18	=	5.7			(29)
Roof	92.47	0	92.47	x	0.11	=	10.17			(30)
Total area of elements, m²			181.64							(31)
Party wall			21.6	x	0	=	0			(32)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 51.56 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 17.41 (36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	68.98	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	105.6	105.6	105.6	105.6	105.6	105.6	105.6	105.6	105.6	105.6	105.6	105.6	

Average = $Sum(39)_{1...12}$ /12= 105.6 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14

Average = $Sum(40)_{1...12}$ /12= 1.14 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.66 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.33 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	107.06	103.17	99.28	95.38	91.49	87.6	87.6	91.49	95.38	99.28	103.17	107.06

Total = $Sum(44)_{1...12}$ = 1167.94 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.77	138.86	143.29	124.92	119.87	103.44	95.85	109.99	111.3	129.71	141.59	153.76

Total = $Sum(45)_{1...12}$ = 1531.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.82	20.83	21.49	18.74	17.98	15.52	14.38	16.5	16.7	19.46	21.24	23.06	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	214.05	188.79	198.57	178.42	175.15	156.93	151.13	165.27	164.8	184.99	195.09	209.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	214.05	188.79	198.57	178.42	175.15	156.93	151.13	165.27	164.8	184.99	195.09	209.04	

Output from water heater (annual)$_{1...12}$ | 2182.2 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	97.01	86.11	91.87	84.33	84.08	77.19	76.09	80.79	79.8	87.35	89.87	95.35	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.71	19.28	15.68	11.87	8.88	7.49	8.1	10.52	14.13	17.94	20.93	22.32	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	243.55	246.08	239.71	226.15	209.03	192.95	182.2	179.68	186.04	199.6	216.72	232.8	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	(71)

Water heating gains (Table 5)

(72)m=	130.39	128.14	123.48	117.13	113.01	107.21	102.27	108.59	110.84	117.41	124.83	128.15	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	458.53	456.38	441.74	418.02	393.79	370.52	355.44	361.66	373.88	397.82	425.35	446.14	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	8.51	x	10.63	x	0.5	x	0.8	=	25.08	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	8.51	x	20.32	x	0.5	x	0.8	=	47.94	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	8.51	x	34.53	x	0.5	x	0.8	=	81.46	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	8.51	x	55.46	x	0.5	x	0.8	=	130.84	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	8.51	x	74.72	x	0.5	x	0.8	=	176.25	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	8.51	x	79.99	x	0.5	x	0.8	=	188.68	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	8.51	x	74.68	x	0.5	x	0.8	=	176.16	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	8.51	x	59.25	x	0.5	x	0.8	=	139.76	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	8.51	x	41.52	x	0.5	x	0.8	=	97.94	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	8.51	x	24.19	x	0.5	x	0.8	=	57.06	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	8.51	x	13.12	x	0.5	x	0.8	=	30.94	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	8.51	x	8.86	x	0.5	x	0.8	=	20.91	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
South	0.9x	0.77	x	0.01	x	46.75	x	0.5	x	0.8	=	0.13	(78)
South	0.9x	0.77	x	0.01	x	76.57	x	0.5	x	0.8	=	0.21	(78)
South	0.9x	0.77	x	0.01	x	97.53	x	0.5	x	0.8	=	0.27	(78)

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South	0.9x	0.77	x	0.01	x	110.23	x	0.5	x	0.8	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	114.87	x	0.5	x	0.8	=	0.32	(78)
South	0.9x	0.77	x	0.01	x	110.55	x	0.5	x	0.8	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	108.01	x	0.5	x	0.8	=	0.3	(78)
South	0.9x	0.77	x	0.01	x	104.89	x	0.5	x	0.8	=	0.29	(78)
South	0.9x	0.77	x	0.01	x	101.89	x	0.5	x	0.8	=	0.28	(78)
South	0.9x	0.77	x	0.01	x	82.59	x	0.5	x	0.8	=	0.23	(78)
South	0.9x	0.77	x	0.01	x	55.42	x	0.5	x	0.8	=	0.15	(78)
South	0.9x	0.77	x	0.01	x	40.4	x	0.5	x	0.8	=	0.11	(78)
West	0.9x	0.77	x	4.48	x	19.64	x	0.5	x	0.8	=	24.39	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	4.48	x	38.42	x	0.5	x	0.8	=	47.71	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	4.48	x	63.27	x	0.5	x	0.8	=	78.58	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	4.48	x	92.28	x	0.5	x	0.8	=	114.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	4.48	x	113.09	x	0.5	x	0.8	=	140.44	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	4.48	x	115.77	x	0.5	x	0.8	=	143.77	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	4.48	x	110.22	x	0.5	x	0.8	=	136.88	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	4.48	x	94.68	x	0.5	x	0.8	=	117.57	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	4.48	x	73.59	x	0.5	x	0.8	=	91.39	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	4.48	x	45.59	x	0.5	x	0.8	=	56.62	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	4.48	x	24.49	x	0.5	x	0.8	=	30.41	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)

West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	4.48	x	16.15	x	0.5	x	0.8	=	20.06	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	95.93	185.74	309.96	471.81	604.39	632.29	596.25	493.15	365.73	220.68	119.05	79.36	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	554.45	642.12	751.69	889.84	998.18	1002.81	951.69	854.81	739.61	618.49	544.4	525.5	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.83	0.64	0.48	0.55	0.83	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.77	19.92	20.2	20.56	20.84	20.97	20.99	20.99	20.88	20.5	20.06	19.73	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.77	0.55	0.37	0.44	0.75	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.33	18.55	18.95	19.45	19.82	19.95	19.96	19.96	19.87	19.38	18.75	18.27	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.9	19.1	19.45	19.89	20.23	20.35	20.38	20.37	20.28	19.83	19.27	18.85	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.9	19.1	19.45	19.89	20.23	20.35	20.38	20.37	20.28	19.83	19.27	18.85	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.92	0.79	0.59	0.42	0.48	0.78	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	552.43	637.04	734.78	822.11	787.6	587.6	395.87	413.5	575.66	594.23	540.3	524.02	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1542.04	1499.12	1367.1	1160.91	900.45	607.59	398.74	419.42	652.28	974.32	1285.39	1547.23	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	736.27	579.32	470.44	243.94	83.96	0	0	0	0	282.79	536.47	761.27	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 3694.45 | (98)

Space heating requirement in kWh/m²/year | 39.95 | (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		3694.45	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	2909.38	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	969.79	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2182.2	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1718.48	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	572.83	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	61.7	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		59.84	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	59.84	(331)
Energy for lighting (calculated in Appendix L)		383.45	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit				32	(361)
Heat efficiency of CHP unit				38	(362)
		Energy kWh/year	**Emission factor kg CO2/kWh**	**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	7656.26	x 0.22	1653.75	(363)

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less credit emissions for electricity	–(307a) × (361) ÷ (362) =	2450	x	0.52		-1271.55	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4522.31	x	0.22		976.82	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1447.14	x	0.52		-751.07	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	358.29	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	32.02	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	998.26	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					998.26	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	31.06	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	199.01	(379)
Total CO2, kg/year	sum of (376)…(382) =					1228.33	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					13.28	(384)
EI rating (section 14)						88.03	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: a1-9-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	92.47	(1a) x	2.4	(2a) =	221.93	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.47	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	221.93	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30 ÷ (5) = 0.14 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 — 0 (12)

If no draught lobby, enter 0.05, else enter 0 — 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 5 (17)

If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) — 0.39 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.33 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			7.44	x1/[1/(1.4)+ 0.04]		=	9.86			(27)
Windows Type 2			2.41	x1/[1/(1.4)+ 0.04]		=	3.2			(27)
Windows Type 3			3.92	x1/[1/(1.4)+ 0.04]		=	5.2			(27)
Windows Type 4			0.01	x1/[1/(1.4)+ 0.04]		=	0.01			(27)
Windows Type 5			2.41	x1/[1/(1.4)+ 0.04]		=	3.2			(27)
Windows Type 6			2.41	x1/[1/(1.4)+ 0.04]		=	3.2			(27)
Windows Type 7			2.41	x1/[1/(1.4)+ 0.04]		=	3.2			(27)
Walls Type1	55.39	21.01	34.38	x	0.18	=	6.19			(29)
Walls Type2	33.78	2.1	31.68	x	0.18	=	5.7			(29)
Roof	92.47	0	92.47	x	0.13	=	12.02			(30)
Total area of elements, m²			181.64							(31)
Party wall			21.6	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 53.87 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 21.64 (36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 75.51 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	43	42.75	42.51	41.37	41.15	40.16	40.16	39.98	40.54	41.15	41.59	42.04	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	118.51	118.26	118.02	116.87	116.66	115.67	115.67	115.48	116.05	116.66	117.09	117.54	

Average = Sum(39)$_{1…12}$ /12= 116.87 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.28	1.28	1.28	1.26	1.26	1.25	1.25	1.25	1.26	1.26	1.27	1.27	

Average = Sum(40)$_{1…12}$ /12= 1.26 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.66 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.33 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	107.06	103.17	99.28	95.38	91.49	87.6	87.6	91.49	95.38	99.28	103.17	107.06	

Total = Sum(44)$_{1…12}$ = 1167.94 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.77	138.86	143.29	124.92	119.87	103.44	95.85	109.99	111.3	129.71	141.59	153.76	

Total = Sum(45)$_{1…12}$ = 1531.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.82	20.83	21.49	18.74	17.98	15.52	14.38	16.5	16.7	19.46	21.24	23.06	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.36	180.95	189.89	170.02	166.46	148.53	142.44	156.58	156.39	176.31	186.68	200.35	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.36	180.95	189.89	170.02	166.46	148.53	142.44	156.58	156.39	176.31	186.68	200.35	

Output from water heater (annual)1…12 | 2079.97 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.07	79.84	84.92	77.61	77.13	70.47	69.15	73.85	73.08	80.41	83.15	88.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.71	19.28	15.68	11.87	8.88	7.49	8.1	10.52	14.13	17.94	20.93	22.32	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	243.55	246.08	239.71	226.15	209.03	192.95	182.2	179.68	186.04	199.6	216.72	232.8	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	(71)

Water heating gains (Table 5)

(72)m=	121.06	118.81	114.14	107.79	103.67	97.87	92.94	99.26	101.5	108.07	115.49	118.82	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	452.19	450.04	435.4	411.69	387.45	364.18	349.11	355.33	367.54	391.48	419.01	439.81	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	7.44	x	10.63	x	0.63	x	0.7	=	24.18	(74)
North	0.9x	0.77	x	2.41	x	10.63	x	0.63	x	0.7	=	7.83	(74)
North	0.9x	0.77	x	2.41	x	10.63	x	0.63	x	0.7	=	7.83	(74)
North	0.9x	0.77	x	7.44	x	20.32	x	0.63	x	0.7	=	46.2	(74)
North	0.9x	0.77	x	2.41	x	20.32	x	0.63	x	0.7	=	14.97	(74)
North	0.9x	0.77	x	2.41	x	20.32	x	0.63	x	0.7	=	14.97	(74)
North	0.9x	0.77	x	7.44	x	34.53	x	0.63	x	0.7	=	78.51	(74)
North	0.9x	0.77	x	2.41	x	34.53	x	0.63	x	0.7	=	25.43	(74)
North	0.9x	0.77	x	2.41	x	34.53	x	0.63	x	0.7	=	25.43	(74)
North	0.9x	0.77	x	7.44	x	55.46	x	0.63	x	0.7	=	126.11	(74)
North	0.9x	0.77	x	2.41	x	55.46	x	0.63	x	0.7	=	40.85	(74)
North	0.9x	0.77	x	2.41	x	55.46	x	0.63	x	0.7	=	40.85	(74)
North	0.9x	0.77	x	7.44	x	74.72	x	0.63	x	0.7	=	169.89	(74)
North	0.9x	0.77	x	2.41	x	74.72	x	0.63	x	0.7	=	55.03	(74)
North	0.9x	0.77	x	2.41	x	74.72	x	0.63	x	0.7	=	55.03	(74)
North	0.9x	0.77	x	7.44	x	79.99	x	0.63	x	0.7	=	181.87	(74)
North	0.9x	0.77	x	2.41	x	79.99	x	0.63	x	0.7	=	58.91	(74)
North	0.9x	0.77	x	2.41	x	79.99	x	0.63	x	0.7	=	58.91	(74)
North	0.9x	0.77	x	7.44	x	74.68	x	0.63	x	0.7	=	169.8	(74)
North	0.9x	0.77	x	2.41	x	74.68	x	0.63	x	0.7	=	55	(74)
North	0.9x	0.77	x	2.41	x	74.68	x	0.63	x	0.7	=	55	(74)
North	0.9x	0.77	x	7.44	x	59.25	x	0.63	x	0.7	=	134.71	(74)
North	0.9x	0.77	x	2.41	x	59.25	x	0.63	x	0.7	=	43.64	(74)
North	0.9x	0.77	x	2.41	x	59.25	x	0.63	x	0.7	=	43.64	(74)
North	0.9x	0.77	x	7.44	x	41.52	x	0.63	x	0.7	=	94.4	(74)
North	0.9x	0.77	x	2.41	x	41.52	x	0.63	x	0.7	=	30.58	(74)
North	0.9x	0.77	x	2.41	x	41.52	x	0.63	x	0.7	=	30.58	(74)
North	0.9x	0.77	x	7.44	x	24.19	x	0.63	x	0.7	=	55	(74)
North	0.9x	0.77	x	2.41	x	24.19	x	0.63	x	0.7	=	17.82	(74)
North	0.9x	0.77	x	2.41	x	24.19	x	0.63	x	0.7	=	17.82	(74)
North	0.9x	0.77	x	7.44	x	13.12	x	0.63	x	0.7	=	29.83	(74)
North	0.9x	0.77	x	2.41	x	13.12	x	0.63	x	0.7	=	9.66	(74)
North	0.9x	0.77	x	2.41	x	13.12	x	0.63	x	0.7	=	9.66	(74)
North	0.9x	0.77	x	7.44	x	8.86	x	0.63	x	0.7	=	20.16	(74)
North	0.9x	0.77	x	2.41	x	8.86	x	0.63	x	0.7	=	6.53	(74)
North	0.9x	0.77	x	2.41	x	8.86	x	0.63	x	0.7	=	6.53	(74)
South	0.9x	0.77	x	0.01	x	46.75	x	0.63	x	0.7	=	0.14	(78)
South	0.9x	0.77	x	0.01	x	76.57	x	0.63	x	0.7	=	0.23	(78)
South	0.9x	0.77	x	0.01	x	97.53	x	0.63	x	0.7	=	0.3	(78)

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South	0.9x	0.77	x	0.01	x	110.23	x	0.63	x	0.7	=	0.34	(78)
South	0.9x	0.77	x	0.01	x	114.87	x	0.63	x	0.7	=	0.35	(78)
South	0.9x	0.77	x	0.01	x	110.55	x	0.63	x	0.7	=	0.34	(78)
South	0.9x	0.77	x	0.01	x	108.01	x	0.63	x	0.7	=	0.33	(78)
South	0.9x	0.77	x	0.01	x	104.89	x	0.63	x	0.7	=	0.32	(78)
South	0.9x	0.77	x	0.01	x	101.89	x	0.63	x	0.7	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	82.59	x	0.63	x	0.7	=	0.25	(78)
South	0.9x	0.77	x	0.01	x	55.42	x	0.63	x	0.7	=	0.17	(78)
South	0.9x	0.77	x	0.01	x	40.4	x	0.63	x	0.7	=	0.12	(78)
West	0.9x	0.77	x	3.92	x	19.64	x	0.63	x	0.7	=	23.53	(80)
West	0.9x	0.77	x	2.41	x	19.64	x	0.63	x	0.7	=	14.47	(80)
West	0.9x	0.77	x	2.41	x	19.64	x	0.63	x	0.7	=	14.47	(80)
West	0.9x	0.77	x	3.92	x	38.42	x	0.63	x	0.7	=	46.03	(80)
West	0.9x	0.77	x	2.41	x	38.42	x	0.63	x	0.7	=	28.3	(80)
West	0.9x	0.77	x	2.41	x	38.42	x	0.63	x	0.7	=	28.3	(80)
West	0.9x	0.77	x	3.92	x	63.27	x	0.63	x	0.7	=	75.8	(80)
West	0.9x	0.77	x	2.41	x	63.27	x	0.63	x	0.7	=	46.6	(80)
West	0.9x	0.77	x	2.41	x	63.27	x	0.63	x	0.7	=	46.6	(80)
West	0.9x	0.77	x	3.92	x	92.28	x	0.63	x	0.7	=	110.55	(80)
West	0.9x	0.77	x	2.41	x	92.28	x	0.63	x	0.7	=	67.97	(80)
West	0.9x	0.77	x	2.41	x	92.28	x	0.63	x	0.7	=	67.97	(80)
West	0.9x	0.77	x	3.92	x	113.09	x	0.63	x	0.7	=	135.49	(80)
West	0.9x	0.77	x	2.41	x	113.09	x	0.63	x	0.7	=	83.3	(80)
West	0.9x	0.77	x	2.41	x	113.09	x	0.63	x	0.7	=	83.3	(80)
West	0.9x	0.77	x	3.92	x	115.77	x	0.63	x	0.7	=	138.69	(80)
West	0.9x	0.77	x	2.41	x	115.77	x	0.63	x	0.7	=	85.27	(80)
West	0.9x	0.77	x	2.41	x	115.77	x	0.63	x	0.7	=	85.27	(80)
West	0.9x	0.77	x	3.92	x	110.22	x	0.63	x	0.7	=	132.04	(80)
West	0.9x	0.77	x	2.41	x	110.22	x	0.63	x	0.7	=	81.18	(80)
West	0.9x	0.77	x	2.41	x	110.22	x	0.63	x	0.7	=	81.18	(80)
West	0.9x	0.77	x	3.92	x	94.68	x	0.63	x	0.7	=	113.42	(80)
West	0.9x	0.77	x	2.41	x	94.68	x	0.63	x	0.7	=	69.73	(80)
West	0.9x	0.77	x	2.41	x	94.68	x	0.63	x	0.7	=	69.73	(80)
West	0.9x	0.77	x	3.92	x	73.59	x	0.63	x	0.7	=	88.16	(80)
West	0.9x	0.77	x	2.41	x	73.59	x	0.63	x	0.7	=	54.2	(80)
West	0.9x	0.77	x	2.41	x	73.59	x	0.63	x	0.7	=	54.2	(80)
West	0.9x	0.77	x	3.92	x	45.59	x	0.63	x	0.7	=	54.62	(80)
West	0.9x	0.77	x	2.41	x	45.59	x	0.63	x	0.7	=	33.58	(80)
West	0.9x	0.77	x	2.41	x	45.59	x	0.63	x	0.7	=	33.58	(80)
West	0.9x	0.77	x	3.92	x	24.49	x	0.63	x	0.7	=	29.34	(80)
West	0.9x	0.77	x	2.41	x	24.49	x	0.63	x	0.7	=	18.04	(80)

West	0.9x	0.77	x	2.41	x	24.49	x	0.63	x	0.7	=	18.04	(80)
West	0.9x	0.77	x	3.92	x	16.15	x	0.63	x	0.7	=	19.35	(80)
West	0.9x	0.77	x	2.41	x	16.15	x	0.63	x	0.7	=	11.9	(80)
West	0.9x	0.77	x	2.41	x	16.15	x	0.63	x	0.7	=	11.9	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	92.44	179	298.68	454.64	582.37	609.26	574.53	475.19	352.43	212.66	114.73	76.48	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	544.63	629.04	734.08	866.32	969.83	973.44	923.64	830.52	719.97	604.14	533.74	516.29	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.87	0.7	0.54	0.61	0.87	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.58	19.73	20.02	20.42	20.76	20.94	20.99	20.97	20.82	20.38	19.91	19.55	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.86	19.86	19.86	19.87	19.87	19.88	19.88	19.88	19.88	19.87	19.87	19.86	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.82	0.6	0.41	0.48	0.79	0.97	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.97	18.2	18.62	19.19	19.64	19.84	19.87	19.87	19.73	19.15	18.46	17.93	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.61	18.81	19.18	19.68	20.08	20.28	20.32	20.31	20.17	19.64	19.04	18.58	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.61	18.81	19.18	19.68	20.08	20.28	20.32	20.31	20.17	19.64	19.04	18.58	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.83	0.64	0.46	0.53	0.81	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	542.67	624.44	719.97	812.72	802.14	619.27	423.76	439.72	586.76	584.17	530	514.83	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1695.87	1645.03	1496.34	1260.05	978.09	656.89	430.17	451.83	704.21	1054.82	1398.31	1690.32	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	857.99	685.83	577.61	322.08	130.91	0	0	0	0	350.17	625.18	874.57	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4424.34 (98)

Space heating requirement in kWh/m²/year 47.85 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	857.99	685.83	577.61	322.08	130.91	0	0	0	0	350.17	625.18	874.57		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	917.63	733.51	617.77	344.47	140.01	0	0	0	0	374.51	668.64	935.37		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													4731.91	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	205.36	180.95	189.89	170.02	166.46	148.53	142.44	156.58	156.39	176.31	186.68	200.35		
Efficiency of water heater													79.8	(216)
(217)m=	88.22	88.04	87.59	86.49	84.18	79.8	79.8	79.8	79.8	86.61	87.79	88.29		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	232.8	205.54	216.78	196.57	197.74	186.13	178.5	196.22	195.98	203.56	212.64	226.92		
Total = Sum(219a)$_{1...12}$ =													2449.38	(219)

Annual totals

		kWh/year	kWh/year	
Space heating fuel used, main system 1			4731.91	
Water heating fuel used			2449.38	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			383.45	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1022.09	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	529.07	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1551.16	(265)

TER WorkSheet: New dwelling design stage

Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	199.01	(268)
Total CO2, kg/year			sum of (265)…(271) =		1789.1	(272)

TER =	19.35	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-10-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	54.19	(1a) x	2.4	(2a) =	130.06	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54.19	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	130.06	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	40.99	15.64	25.35	x	0.18	=	4.56			(29)
Walls Type2	24.59	2.1	22.49	x	0.18	=	4.05			(29)
Roof	54.19	0	54.19	x	0.11	=	5.96			(30)
Total area of elements, m²			119.77							(31)
Party wall			16.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 16.32 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 51.32 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	21.46	21.46	21.46	21.46	21.46	21.46	21.46	21.46	21.46	21.46	21.46	21.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	72.78	72.78	72.78	72.78	72.78	72.78	72.78	72.78	72.78	72.78	72.78	72.78	

Average = Sum(39)$_{1…12}$ /12= 72.78 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	

Average = Sum(40)$_{1…12}$ /12= 1.34 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.81 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.27 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	85	81.91	78.82	75.73	72.64	69.55	69.55	72.64	75.73	78.82	81.91	85	

Total = Sum(44)$_{1…12}$ = 927.27 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	126.05	110.25	113.76	99.18	95.17	82.12	76.1	87.32	88.37	102.98	112.41	122.08	

Total = Sum(45)$_{1…12}$ = 1215.8 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.91	16.54	17.06	14.88	14.28	12.32	11.41	13.1	13.26	15.45	16.86	18.31	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.33	160.17	169.04	152.68	150.44	135.62	131.38	142.6	141.86	158.26	165.91	177.35	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.33	160.17	169.04	152.68	150.44	135.62	131.38	142.6	141.86	158.26	165.91	177.35

Output from water heater (annual)$_{1...12}$ — 1866.64 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.13	76.6	82.05	75.77	75.86	70.1	69.52	73.26	72.18	78.46	80.17	84.81	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.09	12.52	10.18	7.71	5.76	4.86	5.26	6.83	9.17	11.64	13.59	14.49	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	158.1	159.74	155.6	146.8	135.69	125.25	118.27	116.63	120.77	129.57	140.68	151.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	(71)

Water heating gains (Table 5)

(72)m=	115.77	113.99	110.28	105.24	101.97	97.36	93.45	98.46	100.25	105.46	111.35	113.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	338.17	336.44	326.27	309.95	293.63	277.68	267.18	272.13	280.39	296.88	315.82	329.8	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
East	0.9x	1	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(76)
East	0.9x	1	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	57.58	111.18	186.35	287.41	372.86	392.4	369.07	302.03	220.89	132.16	71.37	47.72	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	395.75	447.62	512.62	597.36	666.48	670.08	636.25	574.17	501.27	429.04	387.19	377.53	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.82	0.65	0.49	0.56	0.82	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.62	19.78	20.07	20.46	20.78	20.95	20.99	20.98	20.85	20.43	19.95	19.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.91	0.76	0.55	0.36	0.43	0.73	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18	18.23	18.65	19.2	19.61	19.77	19.8	19.8	19.69	19.16	18.48	17.94	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.81	19.01	19.36	19.83	20.2	20.36	20.4	20.39	20.27	19.79	19.21	18.76	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.81	19.01	19.36	19.83	20.2	20.36	20.4	20.39	20.27	19.79	19.21	18.76	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.78	0.59	0.43	0.49	0.77	0.95	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	392.59	441.26	496.07	544.64	522.91	398.04	272.34	283.18	385.32	405.61	381.54	375.05	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1056.32	1026.63	936.16	795.31	618.35	419.16	276.2	290.26	448.83	668.97	881.56	1059.84	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	493.81	393.37	327.42	180.49	71.01	0	0	0	0	195.94	360.02	509.48	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2531.55 (98)

Space heating requirement in kWh/m²/year 46.72 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2531.55	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1993.59	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	664.53	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1866.64	
If DHW from community scheme:			
Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1469.98	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	489.99	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	46.18	(313)

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Cooling System Energy Efficiency Ratio					0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =				0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside					35.07	(330a)
warm air heating system fans					0	(330b)
pump for solar water heating					0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =				35.07	(331)
Energy for lighting (calculated in Appendix L)					248.91	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	5246.3	x	0.22		1133.2	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1678.82	x	0.52		-871.31	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	3868.37	x	0.22		835.57	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1237.88	x	0.52		-642.46	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	268.15	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	23.97	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	747.12	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					747.12	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	18.2	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	129.18	(379)
Total CO2, kg/year	sum of (376)…(382) =					894.5	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					16.51	(384)
EI rating (section 14)						87.92	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-10-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	54.19	(1a) x	2.4	(2a) =	130.06	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54.19	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	130.06	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.02	x1/[1/(1.4)+ 0.04]		=	2.68			(27)
Windows Type 2			3.37	x1/[1/(1.4)+ 0.04]		=	4.47			(27)
Windows Type 3			2.02	x1/[1/(1.4)+ 0.04]		=	2.68			(27)
Windows Type 4			2.02	x1/[1/(1.4)+ 0.04]		=	2.68			(27)
Windows Type 5			2.02	x1/[1/(1.4)+ 0.04]		=	2.68			(27)
Walls Type1	40.99	11.45	29.54	x	0.18	=	5.32			(29)
Walls Type2	24.59	2.1	22.49	x	0.18	=	4.05			(29)
Roof	54.19	0	54.19	x	0.13	=	7.04			(30)
Total area of elements, m²			119.77							(31)
Party wall			16.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	33.69	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		18.25	(36)
if details of thermal bridging are not known (36) = 0.15 x (31)			
Total fabric heat loss	(33) + (36) =	51.94	(37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.57	25.41	25.25	24.52	24.38	23.74	23.74	23.62	23.99	24.38	24.66	24.95	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	77.51	77.35	77.19	76.45	76.32	75.68	75.68	75.56	75.92	76.32	76.6	76.89	

Average = Sum(39)$_{1\ldots12}$ /12= 76.45 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.43	1.43	1.42	1.41	1.41	1.4	1.4	1.39	1.4	1.41	1.41	1.42	

Average = Sum(40)$_{1\ldots12}$ /12= 1.41 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.81 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.27 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	85	81.91	78.82	75.73	72.64	69.55	69.55	72.64	75.73	78.82	81.91	85	

Total = Sum(44)$_{1\ldots12}$ = 927.27 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	126.05	110.25	113.76	99.18	95.17	82.12	76.1	87.32	88.37	102.98	112.41	122.08	

Total = Sum(45)$_{1\ldots12}$ = 1215.8 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.91	16.54	17.06	14.88	14.28	12.32	11.41	13.1	13.26	15.45	16.86	18.31	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	172.65	152.33	160.36	144.27	141.76	127.21	122.69	133.92	133.46	149.58	157.51	168.67	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	172.65	152.33	160.36	144.27	141.76	127.21	122.69	133.92	133.46	149.58	157.51	168.67

Output from water heater (annual)$_{1…12}$ — 1764.42 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	79.19	70.33	75.1	69.05	68.92	63.38	62.58	66.31	65.46	71.52	73.45	77.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.13	12.55	10.2	7.73	5.77	4.88	5.27	6.85	9.19	11.67	13.62	14.52	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	158.1	159.74	155.6	146.8	135.69	125.25	118.27	116.63	120.77	129.57	140.68	151.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	(71)

Water heating gains (Table 5)

(72)m=	106.44	104.65	100.94	95.91	92.63	88.03	84.11	89.13	90.91	96.13	102.02	104.66	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	331.86	330.14	319.95	303.64	287.3	271.36	260.86	265.81	274.07	290.57	309.52	323.5	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	2.02	x	10.63	x	0.63	x	0.7	=	6.56	(74)
North	0.9x	0.77	x	2.02	x	10.63	x	0.63	x	0.7	=	6.56	(74)
North	0.9x	0.77	x	2.02	x	10.63	x	0.63	x	0.7	=	6.56	(74)
North	0.9x	0.77	x	2.02	x	10.63	x	0.63	x	0.7	=	6.56	(74)
North	0.9x	0.77	x	2.02	x	20.32	x	0.63	x	0.7	=	12.54	(74)
North	0.9x	0.77	x	2.02	x	20.32	x	0.63	x	0.7	=	12.54	(74)
North	0.9x	0.77	x	2.02	x	20.32	x	0.63	x	0.7	=	12.54	(74)
North	0.9x	0.77	x	2.02	x	20.32	x	0.63	x	0.7	=	12.54	(74)
North	0.9x	0.77	x	2.02	x	34.53	x	0.63	x	0.7	=	21.32	(74)
North	0.9x	0.77	x	2.02	x	34.53	x	0.63	x	0.7	=	21.32	(74)
North	0.9x	0.77	x	2.02	x	34.53	x	0.63	x	0.7	=	21.32	(74)
North	0.9x	0.77	x	2.02	x	34.53	x	0.63	x	0.7	=	21.32	(74)
North	0.9x	0.77	x	2.02	x	55.46	x	0.63	x	0.7	=	34.24	(74)
North	0.9x	0.77	x	2.02	x	55.46	x	0.63	x	0.7	=	34.24	(74)
North	0.9x	0.77	x	2.02	x	55.46	x	0.63	x	0.7	=	34.24	(74)
North	0.9x	0.77	x	2.02	x	55.46	x	0.63	x	0.7	=	34.24	(74)
North	0.9x	0.77	x	2.02	x	74.72	x	0.63	x	0.7	=	46.12	(74)
North	0.9x	0.77	x	2.02	x	74.72	x	0.63	x	0.7	=	46.12	(74)
North	0.9x	0.77	x	2.02	x	74.72	x	0.63	x	0.7	=	46.12	(74)
North	0.9x	0.77	x	2.02	x	74.72	x	0.63	x	0.7	=	46.12	(74)
North	0.9x	0.77	x	2.02	x	79.99	x	0.63	x	0.7	=	49.38	(74)
North	0.9x	0.77	x	2.02	x	79.99	x	0.63	x	0.7	=	49.38	(74)
North	0.9x	0.77	x	2.02	x	79.99	x	0.63	x	0.7	=	49.38	(74)
North	0.9x	0.77	x	2.02	x	79.99	x	0.63	x	0.7	=	49.38	(74)
North	0.9x	0.77	x	2.02	x	74.68	x	0.63	x	0.7	=	46.1	(74)
North	0.9x	0.77	x	2.02	x	74.68	x	0.63	x	0.7	=	46.1	(74)
North	0.9x	0.77	x	2.02	x	74.68	x	0.63	x	0.7	=	46.1	(74)
North	0.9x	0.77	x	2.02	x	74.68	x	0.63	x	0.7	=	46.1	(74)
North	0.9x	0.77	x	2.02	x	59.25	x	0.63	x	0.7	=	36.58	(74)
North	0.9x	0.77	x	2.02	x	59.25	x	0.63	x	0.7	=	36.58	(74)
North	0.9x	0.77	x	2.02	x	59.25	x	0.63	x	0.7	=	36.58	(74)
North	0.9x	0.77	x	2.02	x	59.25	x	0.63	x	0.7	=	36.58	(74)
North	0.9x	0.77	x	2.02	x	41.52	x	0.63	x	0.7	=	25.63	(74)
North	0.9x	0.77	x	2.02	x	41.52	x	0.63	x	0.7	=	25.63	(74)
North	0.9x	0.77	x	2.02	x	41.52	x	0.63	x	0.7	=	25.63	(74)
North	0.9x	0.77	x	2.02	x	41.52	x	0.63	x	0.7	=	25.63	(74)
North	0.9x	0.77	x	2.02	x	24.19	x	0.63	x	0.7	=	14.93	(74)
North	0.9x	0.77	x	2.02	x	24.19	x	0.63	x	0.7	=	14.93	(74)
North	0.9x	0.77	x	2.02	x	24.19	x	0.63	x	0.7	=	14.93	(74)
North	0.9x	0.77	x	2.02	x	24.19	x	0.63	x	0.7	=	14.93	(74)
North	0.9x	0.77	x	2.02	x	13.12	x	0.63	x	0.7	=	8.1	(74)

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North	0.9x	0.77	x	2.02	x	13.12	x	0.63	x	0.7	=	8.1	(74)
North	0.9x	0.77	x	2.02	x	13.12	x	0.63	x	0.7	=	8.1	(74)
North	0.9x	0.77	x	2.02	x	13.12	x	0.63	x	0.7	=	8.1	(74)
North	0.9x	0.77	x	2.02	x	8.86	x	0.63	x	0.7	=	5.47	(74)
North	0.9x	0.77	x	2.02	x	8.86	x	0.63	x	0.7	=	5.47	(74)
North	0.9x	0.77	x	2.02	x	8.86	x	0.63	x	0.7	=	5.47	(74)
North	0.9x	0.77	x	2.02	x	8.86	x	0.63	x	0.7	=	5.47	(74)
East	0.9x	1	x	3.37	x	19.64	x	0.63	x	0.7	=	20.23	(76)
East	0.9x	1	x	3.37	x	38.42	x	0.63	x	0.7	=	39.57	(76)
East	0.9x	1	x	3.37	x	63.27	x	0.63	x	0.7	=	65.17	(76)
East	0.9x	1	x	3.37	x	92.28	x	0.63	x	0.7	=	95.04	(76)
East	0.9x	1	x	3.37	x	113.09	x	0.63	x	0.7	=	116.48	(76)
East	0.9x	1	x	3.37	x	115.77	x	0.63	x	0.7	=	119.23	(76)
East	0.9x	1	x	3.37	x	110.22	x	0.63	x	0.7	=	113.52	(76)
East	0.9x	1	x	3.37	x	94.68	x	0.63	x	0.7	=	97.51	(76)
East	0.9x	1	x	3.37	x	73.59	x	0.63	x	0.7	=	75.79	(76)
East	0.9x	1	x	3.37	x	45.59	x	0.63	x	0.7	=	46.95	(76)
East	0.9x	1	x	3.37	x	24.49	x	0.63	x	0.7	=	25.22	(76)
East	0.9x	1	x	3.37	x	16.15	x	0.63	x	0.7	=	16.63	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	46.49	89.75	150.43	232	300.98	316.75	297.92	243.81	178.31	106.69	57.61	38.52	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	378.35	419.89	470.39	535.64	588.28	588.1	558.78	509.62	452.38	397.25	367.13	362.03	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.96	0.88	0.73	0.57	0.63	0.87	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.49	19.63	19.92	20.32	20.68	20.9	20.97	20.96	20.78	20.33	19.84	19.46	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.74	19.74	19.74	19.76	19.76	19.77	19.77	19.77	19.76	19.76	19.75	19.75	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.98	0.94	0.83	0.62	0.42	0.49	0.79	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.76	17.97	18.39	18.96	19.45	19.7	19.76	19.75	19.59	18.99	18.29	17.73	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.62	18.8	19.15	19.64	20.06	20.3	20.37	20.36	20.18	19.66	19.06	18.6	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.62	18.8	19.15	19.64	20.06	20.3	20.37	20.36	20.18	19.66	19.06	18.6	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.98	0.94	0.84	0.67	0.5	0.56	0.82	0.96	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	375.73	415.12	459.22	502.24	495.58	394.22	277.14	285.81	370.88	380.64	362.69	359.94	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1110.13	1075.42	976.64	821.18	638.33	431.71	285	298.9	461.92	691.19	916.41	1106.8	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	546.39	443.72	384.96	229.63	106.21	0	0	0	0	231.05	398.68	555.66	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2896.31 (98)

Space heating requirement in kWh/m²/year 53.45 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	546.39	443.72	384.96	229.63	106.21	0	0	0	0	231.05	398.68	555.66		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	584.38	474.57	411.73	245.59	113.59	0	0	0	0	247.11	426.39	594.29		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3097.66	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	172.65	152.33	160.36	144.27	141.76	127.21	122.69	133.92	133.46	149.58	157.51	168.67		
Efficiency of water heater													79.8	(216)
(217)m=	87.68	87.5	87.07	86.05	84.06	79.8	79.8	79.8	79.8	85.97	87.19	87.76		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	196.91	174.09	184.18	167.67	168.65	159.42	153.75	167.82	167.24	173.99	180.65	192.2		
Total = Sum(219a)$_{1...12}$ =													2086.56	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3097.66

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Water heating fuel used			2086.56	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			249.49	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	669.09	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	450.7	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1119.79	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	129.49	(268)
Total CO2, kg/year			sum of (265)…(271) =		1288.2	(272)

TER = 23.77 (273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-10-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	88.34	(1a) x	2.4	(2a) =	212.02	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	88.34	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		212.02	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.82	x1/[1/(1.2)+ 0.04]		=	3.23			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 5			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 6			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 7			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	69.04	20.99	48.05	x	0.18	=	8.65			(29)
Walls Type2	36.6	2.1	34.5	x	0.18	=	6.21			(29)
Roof	88.34	0	88.34	x	0.11	=	9.72			(30)
Total area of elements, m²			193.98							(31)
Party wall			21.68	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	51.13	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	21.1	(36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 72.23 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.98	34.98	34.98	34.98	34.98	34.98	34.98	34.98	34.98	34.98	34.98	34.98	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	107.22	107.22	107.22	107.22	107.22	107.22	107.22	107.22	107.22	107.22	107.22	107.22

Average = Sum(39)1…12 /12= 107.22 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21

Average = Sum(40)1…12 /12= 1.21 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.6 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	105.61	101.77	97.92	94.08	90.24	86.4	86.4	90.24	94.08	97.92	101.77	105.61

Total = Sum(44)1…12 = 1152.06 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	156.61	136.97	141.34	123.23	118.24	102.03	94.55	108.49	109.79	127.95	139.67	151.67

Total = Sum(45)1…12 = 1510.53 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.49	20.55	21.2	18.48	17.74	15.3	14.18	16.27	16.47	19.19	20.95	22.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.89	186.9	196.62	176.72	173.52	155.52	149.82	163.77	163.28	183.23	193.16	206.94	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.89	186.9	196.62	176.72	173.52	155.52	149.82	163.77	163.28	183.23	193.16	206.94

Output from water heater (annual)$_{1...12}$ | 2161.37 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	96.29	85.49	91.22	83.77	83.54	76.72	75.66	80.3	79.3	86.76	89.23	94.65	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.04	18.69	15.2	11.5	8.6	7.26	7.85	10.2	13.69	17.38	20.28	21.62	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	235.99	238.44	232.27	219.13	202.55	186.96	176.55	174.1	180.27	193.41	209.99	225.58	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	(71)

Water heating gains (Table 5)

(72)m=	129.43	127.21	122.6	116.34	112.28	106.56	101.69	107.92	110.14	116.62	123.94	127.22	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	448.49	446.37	432.1	409.01	385.46	362.81	348.12	354.26	366.13	389.44	416.25	436.46	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	5.29	x	46.75	x	0.5	x	0.8	=	68.56	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	5.29	x	76.57	x	0.5	x	0.8	=	112.28	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	5.29	x	97.53	x	0.5	x	0.8	=	143.02	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	5.29	x	110.23	x	0.5	x	0.8	=	161.65	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	5.29	x	114.87	x	0.5	x	0.8	=	168.45	(78)

South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	5.29	x	110.55	x	0.5	x	0.8	=	162.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	5.29	x	108.01	x	0.5	x	0.8	=	158.39	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	5.29	x	104.89	x	0.5	x	0.8	=	153.82	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	5.29	x	101.89	x	0.5	x	0.8	=	149.4	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	5.29	x	82.59	x	0.5	x	0.8	=	121.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	5.29	x	55.42	x	0.5	x	0.8	=	81.26	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
South	0.9x	0.77	x	5.29	x	40.4	x	0.5	x	0.8	=	59.24	(78)
West	0.9x	0.77	x	2.82	x	19.64	x	0.5	x	0.8	=	15.35	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.82	x	38.42	x	0.5	x	0.8	=	30.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.82	x	63.27	x	0.5	x	0.8	=	49.46	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.82	x	92.28	x	0.5	x	0.8	=	72.14	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.82	x	113.09	x	0.5	x	0.8	=	88.41	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.82	x	115.77	x	0.5	x	0.8	=	90.5	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.82	x	110.22	x	0.5	x	0.8	=	86.16	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.82	x	94.68	x	0.5	x	0.8	=	74.01	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.82	x	73.59	x	0.5	x	0.8	=	57.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.82	x	45.59	x	0.5	x	0.8	=	35.64	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)

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West	0.9x	0.77	x	2.82	x	24.49	x	0.5	x	0.8	=	19.14	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.82	x	16.15	x	0.5	x	0.8	=	12.63	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	188.6	328.13	462.08	586.15	662.9	659.28	635.25	578.88	505.75	366.68	227.28	160.45	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	637.09	774.5	894.18	995.16	1048.36	1022.1	983.37	933.14	871.88	756.12	643.52	596.9	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.92	0.81	0.64	0.47	0.52	0.75	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.78	19.99	20.28	20.6	20.84	20.96	20.99	20.99	20.91	20.58	20.1	19.73	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.91	19.91	19.91	19.91	19.91	19.91	19.91	19.91	19.91	19.91	19.91	19.91	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.89	0.75	0.54	0.36	0.4	0.67	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.31	18.61	19.02	19.46	19.76	19.89	19.91	19.9	19.85	19.44	18.77	18.23	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.9	19.16	19.52	19.91	20.19	20.32	20.34	20.34	20.27	19.9	19.3	18.83	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.9	19.16	19.52	19.91	20.19	20.32	20.34	20.34	20.27	19.9	19.3	18.83	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.89	0.77	0.58	0.4	0.45	0.7	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	632.08	759.75	853.49	886.15	802.04	590.78	397.9	417.11	608.88	695.78	632.62	593.36	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1565.21	1528.85	1395.99	1180.67	910.66	612.81	401.08	422.24	661.83	996.89	1308.51	1568.75	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	694.25	516.83	403.62	212.05	80.82	0	0	0	0	224.03	486.64	725.69	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 3343.94 (98)

Space heating requirement in kWh/m²/year 37.85 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		3343.94	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	2633.35	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	877.78	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2161.37	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1702.08	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	567.36	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	57.81	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		57.16	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	57.16	(331)
Energy for lighting (calculated in Appendix L)		371.55	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	6929.87	x	0.22	1496.85	(363)

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less credit emissions for electricity	–(307a) × (361) ÷ (362) =	2217.56	x	0.52		-1150.91	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4479.16	x	0.22		967.5	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1433.33	x	0.52		-743.9	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	335.65	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	30	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	935.19	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					935.19	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	29.67	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	192.83	(379)
Total CO2, kg/year	sum of (376)…(382) =					1157.69	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					13.1	(384)
EI rating (section 14)						88.37	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-10-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	88.34	(1a) x	2.4	(2a) =	212.02	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	88.34	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	212.02	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30 ÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.39	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.63	x1/[1/(1.4)+ 0.04]		=	3.49			(27)
Windows Type 2			2.68	x1/[1/(1.4)+ 0.04]		=	3.55			(27)
Windows Type 3			2.63	x1/[1/(1.4)+ 0.04]		=	3.49			(27)
Windows Type 4			1.75	x1/[1/(1.4)+ 0.04]		=	2.32			(27)
Windows Type 5			5.04	x1/[1/(1.4)+ 0.04]		=	6.68			(27)
Windows Type 6			2.63	x1/[1/(1.4)+ 0.04]		=	3.49			(27)
Windows Type 7			2.63	x1/[1/(1.4)+ 0.04]		=	3.49			(27)
Walls Type1	69.04	19.99	49.05	x	0.18	=	8.83			(29)
Walls Type2	36.6	2.1	34.5	x	0.18	=	6.21			(29)
Roof	88.34	0	88.34	x	0.13	=	11.48			(30)
Total area of elements, m²			193.98							(31)
Party wall			21.68	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	55.13	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	24.62	(36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 79.75 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.28	41.04	40.8	39.67	39.46	38.48	38.48	38.3	38.86	39.46	39.89	40.33	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	121.03	120.79	120.55	119.42	119.21	118.23	118.23	118.05	118.61	119.21	119.64	120.08	

Average = Sum(39)1…12 /12= 119.42 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.37	1.37	1.36	1.35	1.35	1.34	1.34	1.34	1.34	1.35	1.35	1.36	

Average = Sum(40)1…12 /12= 1.35 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.6 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	105.61	101.77	97.92	94.08	90.24	86.4	86.4	90.24	94.08	97.92	101.77	105.61	

Total = Sum(44)1…12 = 1152.06 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	156.61	136.97	141.34	123.23	118.24	102.03	94.55	108.49	109.79	127.95	139.67	151.67	

Total = Sum(45)1…12 = 1510.53 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.49	20.55	21.2	18.48	17.74	15.3	14.18	16.27	16.47	19.19	20.95	22.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	203.2	179.06	187.94	168.32	164.83	147.12	141.14	155.09	154.88	174.54	184.76	198.26	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	203.2	179.06	187.94	168.32	164.83	147.12	141.14	155.09	154.88	174.54	184.76	198.26

Output from water heater (annual)$_{1...12}$ | 2059.15 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.35	79.21	84.27	77.05	76.59	70	68.71	73.35	72.58	79.82	82.51	87.71	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.03	18.68	15.19	11.5	8.6	7.26	7.84	10.2	13.68	17.38	20.28	21.62	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	235.99	238.44	232.27	219.13	202.55	186.96	176.55	174.1	180.27	193.41	209.99	225.58	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	(71)

Water heating gains (Table 5)

(72)m=	120.09	117.87	113.27	107.01	102.94	97.22	92.36	98.59	100.8	107.28	114.6	117.88	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	442.15	440.03	425.77	402.68	379.12	356.48	341.78	347.92	359.79	383.1	409.91	430.12	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.63	x	19.64	x	0.63	x	0.7	=	15.79	(76)
East	0.9x	1	x	2.63	x	19.64	x	0.63	x	0.7	=	15.79	(76)
East	0.9x	1	x	2.63	x	38.42	x	0.63	x	0.7	=	30.88	(76)
East	0.9x	1	x	2.63	x	38.42	x	0.63	x	0.7	=	30.88	(76)
East	0.9x	1	x	2.63	x	63.27	x	0.63	x	0.7	=	50.86	(76)
East	0.9x	1	x	2.63	x	63.27	x	0.63	x	0.7	=	50.86	(76)
East	0.9x	1	x	2.63	x	92.28	x	0.63	x	0.7	=	74.17	(76)
East	0.9x	1	x	2.63	x	92.28	x	0.63	x	0.7	=	74.17	(76)
East	0.9x	1	x	2.63	x	113.09	x	0.63	x	0.7	=	90.9	(76)
East	0.9x	1	x	2.63	x	113.09	x	0.63	x	0.7	=	90.9	(76)
East	0.9x	1	x	2.63	x	115.77	x	0.63	x	0.7	=	93.05	(76)
East	0.9x	1	x	2.63	x	115.77	x	0.63	x	0.7	=	93.05	(76)
East	0.9x	1	x	2.63	x	110.22	x	0.63	x	0.7	=	88.59	(76)
East	0.9x	1	x	2.63	x	110.22	x	0.63	x	0.7	=	88.59	(76)
East	0.9x	1	x	2.63	x	94.68	x	0.63	x	0.7	=	76.1	(76)
East	0.9x	1	x	2.63	x	94.68	x	0.63	x	0.7	=	76.1	(76)
East	0.9x	1	x	2.63	x	73.59	x	0.63	x	0.7	=	59.15	(76)
East	0.9x	1	x	2.63	x	73.59	x	0.63	x	0.7	=	59.15	(76)
East	0.9x	1	x	2.63	x	45.59	x	0.63	x	0.7	=	36.64	(76)
East	0.9x	1	x	2.63	x	45.59	x	0.63	x	0.7	=	36.64	(76)
East	0.9x	1	x	2.63	x	24.49	x	0.63	x	0.7	=	19.68	(76)
East	0.9x	1	x	2.63	x	24.49	x	0.63	x	0.7	=	19.68	(76)
East	0.9x	1	x	2.63	x	16.15	x	0.63	x	0.7	=	12.98	(76)
East	0.9x	1	x	2.63	x	16.15	x	0.63	x	0.7	=	12.98	(76)
South	0.9x	0.77	x	2.63	x	46.75	x	0.63	x	0.7	=	37.58	(78)
South	0.9x	0.77	x	1.75	x	46.75	x	0.63	x	0.7	=	25	(78)
South	0.9x	0.77	x	5.04	x	46.75	x	0.63	x	0.7	=	72.01	(78)
South	0.9x	0.77	x	2.63	x	76.57	x	0.63	x	0.7	=	61.54	(78)
South	0.9x	0.77	x	1.75	x	76.57	x	0.63	x	0.7	=	40.95	(78)
South	0.9x	0.77	x	5.04	x	76.57	x	0.63	x	0.7	=	117.94	(78)
South	0.9x	0.77	x	2.63	x	97.53	x	0.63	x	0.7	=	78.39	(78)
South	0.9x	0.77	x	1.75	x	97.53	x	0.63	x	0.7	=	52.16	(78)
South	0.9x	0.77	x	5.04	x	97.53	x	0.63	x	0.7	=	150.23	(78)
South	0.9x	0.77	x	2.63	x	110.23	x	0.63	x	0.7	=	88.6	(78)
South	0.9x	0.77	x	1.75	x	110.23	x	0.63	x	0.7	=	58.96	(78)
South	0.9x	0.77	x	5.04	x	110.23	x	0.63	x	0.7	=	169.79	(78)
South	0.9x	0.77	x	2.63	x	114.87	x	0.63	x	0.7	=	92.33	(78)
South	0.9x	0.77	x	1.75	x	114.87	x	0.63	x	0.7	=	61.44	(78)
South	0.9x	0.77	x	5.04	x	114.87	x	0.63	x	0.7	=	176.93	(78)

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South	0.9x	0.77	x	2.63	x	110.55	x	0.63	x	0.7	=	88.85	(78)
South	0.9x	0.77	x	1.75	x	110.55	x	0.63	x	0.7	=	59.12	(78)
South	0.9x	0.77	x	5.04	x	110.55	x	0.63	x	0.7	=	170.28	(78)
South	0.9x	0.77	x	2.63	x	108.01	x	0.63	x	0.7	=	86.82	(78)
South	0.9x	0.77	x	1.75	x	108.01	x	0.63	x	0.7	=	57.77	(78)
South	0.9x	0.77	x	5.04	x	108.01	x	0.63	x	0.7	=	166.37	(78)
South	0.9x	0.77	x	2.63	x	104.89	x	0.63	x	0.7	=	84.31	(78)
South	0.9x	0.77	x	1.75	x	104.89	x	0.63	x	0.7	=	56.1	(78)
South	0.9x	0.77	x	5.04	x	104.89	x	0.63	x	0.7	=	161.57	(78)
South	0.9x	0.77	x	2.63	x	101.89	x	0.63	x	0.7	=	81.89	(78)
South	0.9x	0.77	x	1.75	x	101.89	x	0.63	x	0.7	=	54.49	(78)
South	0.9x	0.77	x	5.04	x	101.89	x	0.63	x	0.7	=	156.93	(78)
South	0.9x	0.77	x	2.63	x	82.59	x	0.63	x	0.7	=	66.38	(78)
South	0.9x	0.77	x	1.75	x	82.59	x	0.63	x	0.7	=	44.17	(78)
South	0.9x	0.77	x	5.04	x	82.59	x	0.63	x	0.7	=	127.21	(78)
South	0.9x	0.77	x	2.63	x	55.42	x	0.63	x	0.7	=	44.54	(78)
South	0.9x	0.77	x	1.75	x	55.42	x	0.63	x	0.7	=	29.64	(78)
South	0.9x	0.77	x	5.04	x	55.42	x	0.63	x	0.7	=	85.36	(78)
South	0.9x	0.77	x	2.63	x	40.4	x	0.63	x	0.7	=	32.47	(78)
South	0.9x	0.77	x	1.75	x	40.4	x	0.63	x	0.7	=	21.61	(78)
South	0.9x	0.77	x	5.04	x	40.4	x	0.63	x	0.7	=	62.22	(78)
West	0.9x	0.77	x	2.68	x	19.64	x	0.63	x	0.7	=	16.09	(80)
West	0.9x	0.77	x	2.63	x	19.64	x	0.63	x	0.7	=	15.79	(80)
West	0.9x	0.77	x	2.68	x	38.42	x	0.63	x	0.7	=	31.47	(80)
West	0.9x	0.77	x	2.63	x	38.42	x	0.63	x	0.7	=	30.88	(80)
West	0.9x	0.77	x	2.68	x	63.27	x	0.63	x	0.7	=	51.82	(80)
West	0.9x	0.77	x	2.63	x	63.27	x	0.63	x	0.7	=	50.86	(80)
West	0.9x	0.77	x	2.68	x	92.28	x	0.63	x	0.7	=	75.58	(80)
West	0.9x	0.77	x	2.63	x	92.28	x	0.63	x	0.7	=	74.17	(80)
West	0.9x	0.77	x	2.68	x	113.09	x	0.63	x	0.7	=	92.63	(80)
West	0.9x	0.77	x	2.63	x	113.09	x	0.63	x	0.7	=	90.9	(80)
West	0.9x	0.77	x	2.68	x	115.77	x	0.63	x	0.7	=	94.82	(80)
West	0.9x	0.77	x	2.63	x	115.77	x	0.63	x	0.7	=	93.05	(80)
West	0.9x	0.77	x	2.68	x	110.22	x	0.63	x	0.7	=	90.27	(80)
West	0.9x	0.77	x	2.63	x	110.22	x	0.63	x	0.7	=	88.59	(80)
West	0.9x	0.77	x	2.68	x	94.68	x	0.63	x	0.7	=	77.54	(80)
West	0.9x	0.77	x	2.63	x	94.68	x	0.63	x	0.7	=	76.1	(80)
West	0.9x	0.77	x	2.68	x	73.59	x	0.63	x	0.7	=	60.27	(80)
West	0.9x	0.77	x	2.63	x	73.59	x	0.63	x	0.7	=	59.15	(80)
West	0.9x	0.77	x	2.68	x	45.59	x	0.63	x	0.7	=	37.34	(80)
West	0.9x	0.77	x	2.63	x	45.59	x	0.63	x	0.7	=	36.64	(80)

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West	0.9x	0.77	x	2.68	x	24.49	x	0.63	x	0.7	=	20.06	(80)
West	0.9x	0.77	x	2.63	x	24.49	x	0.63	x	0.7	=	19.68	(80)
West	0.9x	0.77	x	2.68	x	16.15	x	0.63	x	0.7	=	13.23	(80)
West	0.9x	0.77	x	2.63	x	16.15	x	0.63	x	0.7	=	12.98	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	198.04	344.54	485.18	615.45	696.03	692.23	666.99	607.81	531.03	385.02	238.65	168.47	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	640.19	784.57	910.95	1018.12	1075.15	1048.71	1008.78	955.73	890.83	768.12	648.55	598.59	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.93	0.83	0.67	0.5	0.55	0.78	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.59	19.8	20.12	20.49	20.78	20.94	20.99	20.98	20.87	20.48	19.95	19.55	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.79	19.79	19.79	19.8	19.8	19.81	19.81	19.81	19.81	19.8	19.8	19.79	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.9	0.77	0.56	0.37	0.42	0.69	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.93	18.25	18.7	19.22	19.59	19.77	19.81	19.81	19.71	19.22	18.48	17.88	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.59	18.87	19.27	19.73	20.07	20.24	20.28	20.27	20.18	19.73	19.07	18.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.59	18.87	19.27	19.73	20.07	20.24	20.28	20.27	20.18	19.73	19.07	18.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.9	0.78	0.6	0.43	0.47	0.72	0.93	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	634.98	769.75	871.49	914.65	842.93	631.57	429.01	448.38	642.53	711.23	637.69	594.87	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1730.01	1687.78	1539.23	1293	997.44	666.77	434.88	457.43	720.91	1087.89	1431.87	1722.67	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	814.7	616.92	496.8	272.41	114.95	0	0	0	0	280.23	571.82	839.08	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = | 4006.91 | (98)

Space heating requirement in kWh/m²/year | 45.36 | (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	814.7	616.92	496.8	272.41	114.95	0	0	0	0	280.23	571.82	839.08		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	871.34	659.81	531.33	291.35	122.94	0	0	0	0	299.71	611.57	897.41		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													4285.46	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	203.2	179.06	187.94	168.32	164.83	147.12	141.14	155.09	154.88	174.54	184.76	198.26		
Efficiency of water heater													79.8	(216)
(217)m=	88.14	87.85	87.29	86.09	83.87	79.8	79.8	79.8	79.8	86.07	87.63	88.24		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	230.55	203.82	215.31	195.51	196.52	184.36	176.87	194.35	194.09	202.79	210.84	224.69		
Total = Sum(219a)$_{1...12}$ =													2429.69	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			4285.46	
Water heating fuel used			2429.69	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			371.48	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	925.66	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	524.81	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1450.47	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	192.8	(268)
Total CO2, kg/year		sum of (265)…(271) =		1682.2	(272)

TER = 19.04 (273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-10-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.36	(1a) x	2.4	(2a) =	178.46	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.36	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	178.46	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			5.48	x1/[1/(1.2)+ 0.04]		=	6.27			(27)
Windows Type 5			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 6			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	39.66	18.36	21.3	x	0.18	=	3.83			(29)
Walls Type2	16.48	2.1	14.38	x	0.18	=	2.59			(29)
Roof	74.36	0	74.36	x	0.11	=	8.18			(30)
Total area of elements, m²			130.5							(31)
Party wall			37.04	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.14 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 17.22 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

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Total fabric heat loss (33) + (36) = 55.37 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.45	29.45	29.45	29.45	29.45	29.45	29.45	29.45	29.45	29.45	29.45	29.45	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	84.81	84.81	84.81	84.81	84.81	84.81	84.81	84.81	84.81	84.81	84.81	84.81	

Average = Sum(39)$_{1…12}$ /12= 84.81 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	

Average = Sum(40)$_{1…12}$ /12= 1.14 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.95 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.94	95.34	91.74	88.15	84.55	80.95	80.95	84.55	88.15	91.74	95.34	98.94	

Total = Sum(44)$_{1…12}$ = 1079.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.72	128.33	132.42	115.45	110.78	95.59	88.58	101.65	102.86	119.87	130.85	142.09	

Total = Sum(45)$_{1…12}$ = 1415.19 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.01	19.25	19.86	17.32	16.62	14.34	13.29	15.25	15.43	17.98	19.63	21.31	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202	178.25	187.7	168.94	166.05	149.08	143.86	156.92	156.35	175.15	184.34	197.37	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202	178.25	187.7	168.94	166.05	149.08	143.86	156.92	156.35	175.15	184.34	197.37	

Output from water heater (annual)$_{1...12}$ — 2066.03 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.01	82.61	88.25	81.18	81.05	74.58	73.67	78.02	77	84.08	86.3	91.47	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.48	16.41	13.35	10.1	7.55	6.38	6.89	8.96	12.02	15.26	17.81	18.99	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	207.25	209.4	203.98	192.45	177.88	164.19	155.05	152.9	158.32	169.86	184.42	198.11	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	(71)

Water heating gains (Table 5)

(72)m=	125.01	122.93	118.62	112.75	108.94	103.58	99.02	104.86	106.94	113.01	119.86	122.94	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	408.95	406.95	394.15	373.51	352.59	332.36	319.17	324.93	335.48	356.34	380.31	398.25	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.48	x	10.63	x	0.5	x	0.8	=	16.15	(74)
North	0.9x	0.77	x	5.48	x	20.32	x	0.5	x	0.8	=	30.87	(74)
North	0.9x	0.77	x	5.48	x	34.53	x	0.5	x	0.8	=	52.45	(74)
North	0.9x	0.77	x	5.48	x	55.46	x	0.5	x	0.8	=	84.25	(74)
North	0.9x	0.77	x	5.48	x	74.72	x	0.5	x	0.8	=	113.5	(74)
North	0.9x	0.77	x	5.48	x	79.99	x	0.5	x	0.8	=	121.5	(74)
North	0.9x	0.77	x	5.48	x	74.68	x	0.5	x	0.8	=	113.44	(74)
North	0.9x	0.77	x	5.48	x	59.25	x	0.5	x	0.8	=	90	(74)
North	0.9x	0.77	x	5.48	x	41.52	x	0.5	x	0.8	=	63.07	(74)
North	0.9x	0.77	x	5.48	x	24.19	x	0.5	x	0.8	=	36.75	(74)
North	0.9x	0.77	x	5.48	x	13.12	x	0.5	x	0.8	=	19.93	(74)
North	0.9x	0.77	x	5.48	x	8.86	x	0.5	x	0.8	=	13.47	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)

West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.28	168.04	278.36	413.72	517.28	534.84	506.95	428.02	325.8	199.51	107.36	71.13	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	495.22	575	672.51	787.23	869.86	867.2	826.12	752.95	661.29	555.85	487.67	469.38	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	1	0.99	0.98	0.92	0.79	0.6	0.45	0.51	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.83	19.99	20.28	20.62	20.87	20.97	21	20.99	20.91	20.56	20.12	19.79	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.73	0.52	0.34	0.4	0.7	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.42	18.65	19.06	19.54	19.85	19.95	19.97	19.96	19.9	19.47	18.84	18.36	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.98	19.19	19.55	19.97	20.26	20.36	20.38	20.38	20.31	19.91	19.35	18.93	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.98	19.19	19.55	19.97	20.26	20.36	20.38	20.38	20.31	19.91	19.35	18.93	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.9	0.75	0.55	0.39	0.44	0.73	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	492.4	567.97	650.18	707.8	653.73	476.53	318.78	333.93	481.16	524.16	481.98	467.3	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1245.44	1212.04	1106.55	939.1	726.03	488.61	320.41	337.15	526.35	789.2	1039.2	1249.29	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	560.26	432.82	339.54	166.54	53.78	0	0	0	0	197.19	401.2	581.8	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 2733.13 | (98)

Space heating requirement in kWh/m²/year | 36.76 | (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)

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Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2733.13	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	2152.34	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	717.45	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2066.03	
If DHW from community scheme:			
Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1627	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	542.33	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	50.39	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		48.12	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	48.12	(331)
Energy for lighting (calculated in Appendix L)		326.3	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	5664.06	x	0.22		1223.44	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1812.5	x	0.52		-940.69	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4281.57	x	0.22		924.82	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1370.1	x	0.52		-711.08	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	292.59	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	26.15	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	815.23	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					815.23	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	24.97	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	169.35	(379)
Total CO2, kg/year	sum of (376)…(382) =			1009.56	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			13.58	(384)
EI rating (section 14)				88.67	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-10-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.36	(1a) x	2.4	(2a) =	178.46	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.36	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	178.46	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.48	x1/[1/(1.4)+ 0.04]		=	3.29			(27)
Windows Type 2			2.48	x1/[1/(1.4)+ 0.04]		=	3.29			(27)
Windows Type 3			2.48	x1/[1/(1.4)+ 0.04]		=	3.29			(27)
Windows Type 4			4.92	x1/[1/(1.4)+ 0.04]		=	6.52			(27)
Windows Type 5			1.65	x1/[1/(1.4)+ 0.04]		=	2.19			(27)
Windows Type 6			2.48	x1/[1/(1.4)+ 0.04]		=	3.29			(27)
Walls Type1	39.66	16.49	23.17	x	0.18	=	4.17			(29)
Walls Type2	16.48	2.1	14.38	x	0.18	=	2.59			(29)
Roof	74.36	0	74.36	x	0.13	=	9.67			(30)
Total area of elements, m²			130.5							(31)
Party wall			37.04	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.39 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 17.3 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

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Total fabric heat loss	(33) + (36) =	57.69	(37)
Ventilation heat loss calculated monthly	(38)m = 0.33 × (25)m x (5)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.49	35.26	35.03	33.95	33.74	32.8	32.8	32.63	33.17	33.74	34.15	34.58	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	93.18	92.95	92.71	91.63	91.43	90.49	90.49	90.32	90.85	91.43	91.84	92.27	

Average = Sum(39)$_{1...12}$ /12= 91.63 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.25	1.25	1.25	1.23	1.23	1.22	1.22	1.21	1.22	1.23	1.24	1.24	

Average = Sum(40)$_{1...12}$ /12= 1.23 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.95 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.94	95.34	91.74	88.15	84.55	80.95	80.95	84.55	88.15	91.74	95.34	98.94	

Total = Sum(44)$_{1...12}$ = 1079.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.72	128.33	132.42	115.45	110.78	95.59	88.58	101.65	102.86	119.87	130.85	142.09	

Total = Sum(45)$_{1...12}$ = 1415.19 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.01	19.25	19.86	17.32	16.62	14.34	13.29	15.25	15.43	17.98	19.63	21.31	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		150	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)			
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)			
Water storage loss:			
a) If manufacturer's declared loss factor is known (kWh/day):		1.39	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0.75	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.75	(55)

TER WorkSheet: New dwelling design stage

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	193.32	170.41	179.02	160.54	157.37	140.68	135.17	148.24	147.95	166.47	175.94	188.69	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	193.32	170.41	179.02	160.54	157.37	140.68	135.17	148.24	147.95	166.47	175.94	188.69

Output from water heater (annual)$_{1...12}$ 1963.8 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.06	76.34	81.31	74.46	74.11	67.86	66.73	71.07	70.27	77.13	79.58	84.52	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.48	16.41	13.35	10.11	7.55	6.38	6.89	8.96	12.02	15.26	17.82	18.99	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	207.25	209.4	203.98	192.45	177.88	164.19	155.05	152.9	158.32	169.86	184.42	198.11	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	(71)

Water heating gains (Table 5)

(72)m=	115.67	113.6	109.28	103.42	99.61	94.25	89.69	95.53	97.6	103.67	110.53	113.61	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	402.61	400.62	387.82	367.17	346.25	326.02	312.84	318.59	329.15	350	373.97	391.91	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.92	x	10.63	x	0.63	x	0.7	=	15.99	(74)
North	0.9x	0.77	x	4.92	x	20.32	x	0.63	x	0.7	=	30.55	(74)
North	0.9x	0.77	x	4.92	x	34.53	x	0.63	x	0.7	=	51.92	(74)
North	0.9x	0.77	x	4.92	x	55.46	x	0.63	x	0.7	=	83.4	(74)
North	0.9x	0.77	x	4.92	x	74.72	x	0.63	x	0.7	=	112.34	(74)
North	0.9x	0.77	x	4.92	x	79.99	x	0.63	x	0.7	=	120.27	(74)
North	0.9x	0.77	x	4.92	x	74.68	x	0.63	x	0.7	=	112.28	(74)
North	0.9x	0.77	x	4.92	x	59.25	x	0.63	x	0.7	=	89.08	(74)
North	0.9x	0.77	x	4.92	x	41.52	x	0.63	x	0.7	=	62.42	(74)
North	0.9x	0.77	x	4.92	x	24.19	x	0.63	x	0.7	=	36.37	(74)
North	0.9x	0.77	x	4.92	x	13.12	x	0.63	x	0.7	=	19.72	(74)
North	0.9x	0.77	x	4.92	x	8.86	x	0.63	x	0.7	=	13.33	(74)
West	0.9x	0.77	x	2.48	x	19.64	x	0.63	x	0.7	=	14.89	(80)
West	0.9x	0.77	x	2.48	x	19.64	x	0.63	x	0.7	=	14.89	(80)
West	0.9x	0.77	x	2.48	x	19.64	x	0.63	x	0.7	=	14.89	(80)
West	0.9x	0.77	x	1.65	x	19.64	x	0.63	x	0.7	=	9.9	(80)
West	0.9x	0.77	x	2.48	x	19.64	x	0.63	x	0.7	=	14.89	(80)
West	0.9x	0.77	x	2.48	x	38.42	x	0.63	x	0.7	=	29.12	(80)
West	0.9x	0.77	x	2.48	x	38.42	x	0.63	x	0.7	=	29.12	(80)
West	0.9x	0.77	x	2.48	x	38.42	x	0.63	x	0.7	=	29.12	(80)
West	0.9x	0.77	x	1.65	x	38.42	x	0.63	x	0.7	=	19.37	(80)
West	0.9x	0.77	x	2.48	x	38.42	x	0.63	x	0.7	=	29.12	(80)
West	0.9x	0.77	x	2.48	x	63.27	x	0.63	x	0.7	=	47.96	(80)
West	0.9x	0.77	x	2.48	x	63.27	x	0.63	x	0.7	=	47.96	(80)
West	0.9x	0.77	x	2.48	x	63.27	x	0.63	x	0.7	=	47.96	(80)
West	0.9x	0.77	x	1.65	x	63.27	x	0.63	x	0.7	=	31.91	(80)
West	0.9x	0.77	x	2.48	x	63.27	x	0.63	x	0.7	=	47.96	(80)
West	0.9x	0.77	x	2.48	x	92.28	x	0.63	x	0.7	=	69.94	(80)
West	0.9x	0.77	x	2.48	x	92.28	x	0.63	x	0.7	=	69.94	(80)
West	0.9x	0.77	x	2.48	x	92.28	x	0.63	x	0.7	=	69.94	(80)
West	0.9x	0.77	x	1.65	x	92.28	x	0.63	x	0.7	=	46.53	(80)
West	0.9x	0.77	x	2.48	x	92.28	x	0.63	x	0.7	=	69.94	(80)
West	0.9x	0.77	x	2.48	x	113.09	x	0.63	x	0.7	=	85.72	(80)
West	0.9x	0.77	x	2.48	x	113.09	x	0.63	x	0.7	=	85.72	(80)
West	0.9x	0.77	x	2.48	x	113.09	x	0.63	x	0.7	=	85.72	(80)
West	0.9x	0.77	x	1.65	x	113.09	x	0.63	x	0.7	=	57.03	(80)
West	0.9x	0.77	x	2.48	x	113.09	x	0.63	x	0.7	=	85.72	(80)
West	0.9x	0.77	x	2.48	x	115.77	x	0.63	x	0.7	=	87.74	(80)
West	0.9x	0.77	x	2.48	x	115.77	x	0.63	x	0.7	=	87.74	(80)

West	0.9x	0.77	x	2.48	x	115.77	x	0.63	x	0.7	=	87.74	(80)
West	0.9x	0.77	x	1.65	x	115.77	x	0.63	x	0.7	=	58.38	(80)
West	0.9x	0.77	x	2.48	x	115.77	x	0.63	x	0.7	=	87.74	(80)
West	0.9x	0.77	x	2.48	x	110.22	x	0.63	x	0.7	=	83.54	(80)
West	0.9x	0.77	x	2.48	x	110.22	x	0.63	x	0.7	=	83.54	(80)
West	0.9x	0.77	x	2.48	x	110.22	x	0.63	x	0.7	=	83.54	(80)
West	0.9x	0.77	x	1.65	x	110.22	x	0.63	x	0.7	=	55.58	(80)
West	0.9x	0.77	x	2.48	x	110.22	x	0.63	x	0.7	=	83.54	(80)
West	0.9x	0.77	x	2.48	x	94.68	x	0.63	x	0.7	=	71.76	(80)
West	0.9x	0.77	x	2.48	x	94.68	x	0.63	x	0.7	=	71.76	(80)
West	0.9x	0.77	x	2.48	x	94.68	x	0.63	x	0.7	=	71.76	(80)
West	0.9x	0.77	x	1.65	x	94.68	x	0.63	x	0.7	=	47.74	(80)
West	0.9x	0.77	x	2.48	x	94.68	x	0.63	x	0.7	=	71.76	(80)
West	0.9x	0.77	x	2.48	x	73.59	x	0.63	x	0.7	=	55.77	(80)
West	0.9x	0.77	x	2.48	x	73.59	x	0.63	x	0.7	=	55.77	(80)
West	0.9x	0.77	x	2.48	x	73.59	x	0.63	x	0.7	=	55.77	(80)
West	0.9x	0.77	x	1.65	x	73.59	x	0.63	x	0.7	=	37.11	(80)
West	0.9x	0.77	x	2.48	x	73.59	x	0.63	x	0.7	=	55.77	(80)
West	0.9x	0.77	x	2.48	x	45.59	x	0.63	x	0.7	=	34.55	(80)
West	0.9x	0.77	x	2.48	x	45.59	x	0.63	x	0.7	=	34.55	(80)
West	0.9x	0.77	x	2.48	x	45.59	x	0.63	x	0.7	=	34.55	(80)
West	0.9x	0.77	x	1.65	x	45.59	x	0.63	x	0.7	=	22.99	(80)
West	0.9x	0.77	x	2.48	x	45.59	x	0.63	x	0.7	=	34.55	(80)
West	0.9x	0.77	x	2.48	x	24.49	x	0.63	x	0.7	=	18.56	(80)
West	0.9x	0.77	x	2.48	x	24.49	x	0.63	x	0.7	=	18.56	(80)
West	0.9x	0.77	x	2.48	x	24.49	x	0.63	x	0.7	=	18.56	(80)
West	0.9x	0.77	x	1.65	x	24.49	x	0.63	x	0.7	=	12.35	(80)
West	0.9x	0.77	x	2.48	x	24.49	x	0.63	x	0.7	=	18.56	(80)
West	0.9x	0.77	x	2.48	x	16.15	x	0.63	x	0.7	=	12.24	(80)
West	0.9x	0.77	x	2.48	x	16.15	x	0.63	x	0.7	=	12.24	(80)
West	0.9x	0.77	x	2.48	x	16.15	x	0.63	x	0.7	=	12.24	(80)
West	0.9x	0.77	x	1.65	x	16.15	x	0.63	x	0.7	=	8.14	(80)
West	0.9x	0.77	x	2.48	x	16.15	x	0.63	x	0.7	=	12.24	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	85.44	166.41	275.65	409.69	512.23	529.63	502.01	423.85	322.63	197.57	106.32	70.44	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	488.05	567.03	663.47	776.87	858.48	855.65	814.85	742.44	651.78	547.57	480.29	462.35	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	1	0.99	0.98	0.94	0.82	0.64	0.48	0.54	0.81	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.67	19.84	20.14	20.53	20.82	20.96	20.99	20.99	20.88	20.48	20.01	19.65	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.88	19.88	19.88	19.89	19.9	19.91	19.91	19.91	19.9	19.9	19.89	19.89	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.77	0.55	0.37	0.42	0.73	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.12	18.37	18.8	19.35	19.73	19.88	19.9	19.9	19.81	19.3	18.62	18.09	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.74	18.96	19.34	19.82	20.17	20.31	20.34	20.34	20.24	19.77	19.17	18.71	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.74	18.96	19.34	19.82	20.17	20.31	20.34	20.34	20.24	19.77	19.17	18.71	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.78	0.58	0.41	0.47	0.76	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	485.38	560.65	644.1	708.97	670.62	497.75	335.41	350.04	493.38	520.28	475.12	460.37	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1345.93	1306.82	1190.24	1000.82	774.03	516.97	338.33	355.47	557.46	838.33	1108.89	1339.2	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	640.25	501.42	406.33	210.13	76.93	0	0	0	0	236.63	456.31	653.85	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3181.86 (98)

Space heating requirement in kWh/m²/year 42.79 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	640.25	501.42	406.33	210.13	76.93	0	0	0	0	236.63	456.31	653.85	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	684.76	536.28	434.58	224.74	82.28	0	0	0	0	253.08	488.03	699.3	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3403.06 (211)

TER WorkSheet: New dwelling design stage

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

193.32	170.41	179.02	160.54	157.37	140.68	135.17	148.24	147.95	166.47	175.94	188.69

Efficiency of water heater 79.8 (216)

(217)m=	87.77	87.52	86.94	85.53	83.02	79.8	79.8	79.8	79.8	85.75	87.24	87.86

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	220.26	194.7	205.92	187.69	189.55	176.29	169.39	185.76	185.4	194.13	201.67	214.76

Total = Sum(219a)$_{1...12}$ = 2325.53 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3403.06	
Water heating fuel used		2325.53	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		326.34	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	735.06	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	502.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1237.37	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	169.37	(268)
Total CO2, kg/year			sum of (265)…(271) =		1445.67	(272)

TER = 19.44 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-2-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.14	(1a) x	2.4	(2a) =	206.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.14	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	206.74	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 4			8.05	x1/[1/(1.2)+ 0.04]		=	9.22			(27)
Windows Type 5			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Floor			86.14	x	0.11	=	9.4754			(28)
Walls Type1	44.62	19.78	24.84	x	0.18	=	4.47			(29)
Walls Type2	5.87	2.1	3.77	x	0.18	=	0.68			(29)
Total area of elements, m²			136.63							(31)
Party wall			44.11	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.79 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.16 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 54.95 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	89.06	89.06	89.06	89.06	89.06	89.06	89.06	89.06	89.06	89.06	89.06	89.06	

Average = Sum(39)$_{1...12}$ /12= 89.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	

Average = Sum(40)$_{1...12}$ /12= 1.03 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	104.74	100.93	97.12	93.31	89.5	85.69	85.69	89.5	93.31	97.12	100.93	104.74

Total = Sum(44)$_{1...12}$ = 1142.6 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.32	135.85	140.18	122.21	117.27	101.19	93.77	107.6	108.89	126.9	138.52	150.42

Total = Sum(45)$_{1...12}$ = 1498.13 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.3	20.38	21.03	18.33	17.59	15.18	14.07	16.14	16.33	19.03	20.78	22.56	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.6	185.77	195.46	175.71	172.54	154.69	149.05	162.88	162.38	182.17	192.01	205.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	210.6	185.77	195.46	175.71	172.54	154.69	149.05	162.88	162.38	182.17	192.01	205.7

Output from water heater (annual)$_{1…12}$ | 2148.97 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	95.87	85.11	90.83	83.43	83.21	76.44	75.4	80	79	86.42	88.85	94.24	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.66	18.35	14.93	11.3	8.45	7.13	7.71	10.02	13.44	17.07	19.92	21.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	231.79	234.2	228.14	215.23	198.95	183.64	173.41	171	177.07	189.97	206.26	221.57	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	(71)

Water heating gains (Table 5)

(72)m=	128.85	126.65	122.09	115.88	111.85	106.17	101.34	107.53	109.72	116.15	123.41	126.66	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	442.85	440.74	426.69	403.95	380.78	358.47	344	350.08	361.77	384.73	411.12	431.01	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)

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North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
East	0.9x	1	x	8.05	x	19.64	x	0.5	x	0.8	=	43.83	(76)
East	0.9x	1	x	8.05	x	38.42	x	0.5	x	0.8	=	85.73	(76)
East	0.9x	1	x	8.05	x	63.27	x	0.5	x	0.8	=	141.19	(76)
East	0.9x	1	x	8.05	x	92.28	x	0.5	x	0.8	=	205.92	(76)
East	0.9x	1	x	8.05	x	113.09	x	0.5	x	0.8	=	252.36	(76)
East	0.9x	1	x	8.05	x	115.77	x	0.5	x	0.8	=	258.34	(76)
East	0.9x	1	x	8.05	x	110.22	x	0.5	x	0.8	=	245.95	(76)
East	0.9x	1	x	8.05	x	94.68	x	0.5	x	0.8	=	211.27	(76)
East	0.9x	1	x	8.05	x	73.59	x	0.5	x	0.8	=	164.21	(76)
East	0.9x	1	x	8.05	x	45.59	x	0.5	x	0.8	=	101.73	(76)
East	0.9x	1	x	8.05	x	24.49	x	0.5	x	0.8	=	54.65	(76)
East	0.9x	1	x	8.05	x	16.15	x	0.5	x	0.8	=	36.04	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	78.4	151.81	253.47	386.27	495.3	518.41	488.76	403.91	299.2	180.38	97.3	64.86	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.25	592.55	680.16	790.21	876.08	876.89	832.76	753.99	660.97	565.11	508.42	495.87	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.94	0.82	0.63	0.47	0.53	0.81	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.92	20.06	20.31	20.63	20.88	20.98	21	20.99	20.91	20.58	20.18	19.88	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.77	0.54	0.37	0.43	0.74	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.61	18.81	19.17	19.63	19.94	20.04	20.05	20.05	19.99	19.57	19	18.56	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.14	19.31	19.63	20.03	20.32	20.42	20.43	20.43	20.36	19.97	19.47	19.09	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.14	19.31	19.63	20.03	20.32	20.42	20.43	20.43	20.36	19.97	19.47	19.09	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.92	0.78	0.58	0.41	0.47	0.77	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	519.31	587.9	665.07	730.02	687.36	505.7	339.66	355.53	506.03	541.69	504.44	494.45	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1321.48	1283.61	1169.2	991.08	767.35	517.96	341.19	358.77	557.39	834.72	1101.91	1326.09	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	596.82	467.52	375.07	187.97	59.51	0	0	0	0	218.01	430.18	618.74	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2953.81	(98)
Space heating requirement in kWh/m²/year	34.29	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2953.81	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	2326.12	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	775.37	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2148.97	
If DHW from community scheme:			
Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1692.31	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	564.1	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	53.58	(313)

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Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		55.74	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	55.74	(331)
Energy for lighting (calculated in Appendix L)		364.94	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	6121.38	x	0.22		1322.22	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1958.84	x	0.52		-1016.64	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4453.45	x	0.22		961.95	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1425.1	x	0.52		-739.63	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	311.1	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	27.81	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	866.81	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					866.81	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	28.93	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	189.41	(379)
Total CO2, kg/year	sum of (376)…(382) =					1085.14	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					12.6	(384)
EI rating (section 14)						88.91	(385)

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User Details:

Assessor Name: | **Stroma Number:**

Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-2-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.14	(1a) x	2.4	(2a) =	206.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.14	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	206.74	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.71	x1/[1/(1.4)+ 0.04]		=	3.59			(27)
Windows Type 2			1.81	x1/[1/(1.4)+ 0.04]		=	2.4			(27)
Windows Type 3			1.81	x1/[1/(1.4)+ 0.04]		=	2.4			(27)
Windows Type 4			7.91	x1/[1/(1.4)+ 0.04]		=	10.49			(27)
Windows Type 5			5.2	x1/[1/(1.4)+ 0.04]		=	6.89			(27)
Floor			86.14	x	0.13	=	11.1982			(28)
Walls Type1	44.62	19.44	25.18	x	0.18	=	4.53			(29)
Walls Type2	5.87	2.1	3.77	x	0.18	=	0.68			(29)
Total area of elements, m²			136.63							(31)
Party wall			44.11	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 44.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.46 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 58.74 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.37	40.12	39.89	38.77	38.56	37.58	37.58	37.4	37.96	38.56	38.98	39.42	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	99.11	98.86	98.62	97.51	97.3	96.32	96.32	96.14	96.7	97.3	97.72	98.16	

Average = Sum(39)$_{1\ldots12}$ /12= 97.51 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.15	1.15	1.14	1.13	1.13	1.12	1.12	1.12	1.12	1.13	1.13	1.14	

Average = Sum(40)$_{1\ldots12}$ /12= 1.13 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	104.74	100.93	97.12	93.31	89.5	85.69	85.69	89.5	93.31	97.12	100.93	104.74	

Total = Sum(44)$_{1\ldots12}$ = 1142.6 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.32	135.85	140.18	122.21	117.27	101.19	93.77	107.6	108.89	126.9	138.52	150.42	

Total = Sum(45)$_{1\ldots12}$ = 1498.13 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.3	20.38	21.03	18.33	17.59	15.18	14.07	16.14	16.33	19.03	20.78	22.56	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.92	177.93	186.78	167.31	163.86	146.28	140.36	154.2	153.98	173.49	183.61	197.02	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.92	177.93	186.78	167.31	163.86	146.28	140.36	154.2	153.98	173.49	183.61	197.02

Output from water heater (annual)$_{1...12}$ | 2046.74 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	88.92	78.84	83.89	76.71	76.27	69.72	68.45	73.05	72.28	79.47	82.13	87.29	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.66	18.35	14.92	11.3	8.45	7.13	7.7	10.01	13.44	17.07	19.92	21.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	231.79	234.2	228.14	215.23	198.95	183.64	173.41	171	177.07	189.97	206.26	221.57	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	(71)

Water heating gains (Table 5)

(72)m=	119.52	117.32	112.75	106.54	102.51	96.83	92.01	98.19	100.39	106.81	114.07	117.33	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	436.51	434.41	420.35	397.61	374.44	352.14	337.66	343.75	355.43	378.39	404.79	424.67	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	2.71	x	10.63	x	0.63	x	0.7	=	8.81	(74)
North	0.9x	0.77	x	1.81	x	10.63	x	0.63	x	0.7	=	5.88	(74)
North	0.9x	0.77	x	1.81	x	10.63	x	0.63	x	0.7	=	5.88	(74)
North	0.9x	0.77	x	5.2	x	10.63	x	0.63	x	0.7	=	16.9	(74)
North	0.9x	0.77	x	2.71	x	20.32	x	0.63	x	0.7	=	16.83	(74)
North	0.9x	0.77	x	1.81	x	20.32	x	0.63	x	0.7	=	11.24	(74)
North	0.9x	0.77	x	1.81	x	20.32	x	0.63	x	0.7	=	11.24	(74)
North	0.9x	0.77	x	5.2	x	20.32	x	0.63	x	0.7	=	32.29	(74)
North	0.9x	0.77	x	2.71	x	34.53	x	0.63	x	0.7	=	28.6	(74)
North	0.9x	0.77	x	1.81	x	34.53	x	0.63	x	0.7	=	19.1	(74)
North	0.9x	0.77	x	1.81	x	34.53	x	0.63	x	0.7	=	19.1	(74)
North	0.9x	0.77	x	5.2	x	34.53	x	0.63	x	0.7	=	54.88	(74)
North	0.9x	0.77	x	2.71	x	55.46	x	0.63	x	0.7	=	45.94	(74)
North	0.9x	0.77	x	1.81	x	55.46	x	0.63	x	0.7	=	30.68	(74)
North	0.9x	0.77	x	1.81	x	55.46	x	0.63	x	0.7	=	30.68	(74)
North	0.9x	0.77	x	5.2	x	55.46	x	0.63	x	0.7	=	88.14	(74)
North	0.9x	0.77	x	2.71	x	74.72	x	0.63	x	0.7	=	61.88	(74)
North	0.9x	0.77	x	1.81	x	74.72	x	0.63	x	0.7	=	41.33	(74)
North	0.9x	0.77	x	1.81	x	74.72	x	0.63	x	0.7	=	41.33	(74)
North	0.9x	0.77	x	5.2	x	74.72	x	0.63	x	0.7	=	118.74	(74)
North	0.9x	0.77	x	2.71	x	79.99	x	0.63	x	0.7	=	66.24	(74)
North	0.9x	0.77	x	1.81	x	79.99	x	0.63	x	0.7	=	44.24	(74)
North	0.9x	0.77	x	1.81	x	79.99	x	0.63	x	0.7	=	44.24	(74)
North	0.9x	0.77	x	5.2	x	79.99	x	0.63	x	0.7	=	127.11	(74)
North	0.9x	0.77	x	2.71	x	74.68	x	0.63	x	0.7	=	61.85	(74)
North	0.9x	0.77	x	1.81	x	74.68	x	0.63	x	0.7	=	41.31	(74)
North	0.9x	0.77	x	1.81	x	74.68	x	0.63	x	0.7	=	41.31	(74)
North	0.9x	0.77	x	5.2	x	74.68	x	0.63	x	0.7	=	118.68	(74)
North	0.9x	0.77	x	2.71	x	59.25	x	0.63	x	0.7	=	49.07	(74)
North	0.9x	0.77	x	1.81	x	59.25	x	0.63	x	0.7	=	32.77	(74)
North	0.9x	0.77	x	1.81	x	59.25	x	0.63	x	0.7	=	32.77	(74)
North	0.9x	0.77	x	5.2	x	59.25	x	0.63	x	0.7	=	94.15	(74)
North	0.9x	0.77	x	2.71	x	41.52	x	0.63	x	0.7	=	34.38	(74)
North	0.9x	0.77	x	1.81	x	41.52	x	0.63	x	0.7	=	22.97	(74)
North	0.9x	0.77	x	1.81	x	41.52	x	0.63	x	0.7	=	22.97	(74)
North	0.9x	0.77	x	5.2	x	41.52	x	0.63	x	0.7	=	65.98	(74)
North	0.9x	0.77	x	2.71	x	24.19	x	0.63	x	0.7	=	20.03	(74)
North	0.9x	0.77	x	1.81	x	24.19	x	0.63	x	0.7	=	13.38	(74)
North	0.9x	0.77	x	1.81	x	24.19	x	0.63	x	0.7	=	13.38	(74)
North	0.9x	0.77	x	5.2	x	24.19	x	0.63	x	0.7	=	38.44	(74)
North	0.9x	0.77	x	2.71	x	13.12	x	0.63	x	0.7	=	10.86	(74)

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North	0.9x	0.77	x	1.81	x	13.12	x	0.63	x	0.7	=	7.26	(74)
North	0.9x	0.77	x	1.81	x	13.12	x	0.63	x	0.7	=	7.26	(74)
North	0.9x	0.77	x	5.2	x	13.12	x	0.63	x	0.7	=	20.85	(74)
North	0.9x	0.77	x	2.71	x	8.86	x	0.63	x	0.7	=	7.34	(74)
North	0.9x	0.77	x	1.81	x	8.86	x	0.63	x	0.7	=	4.9	(74)
North	0.9x	0.77	x	1.81	x	8.86	x	0.63	x	0.7	=	4.9	(74)
North	0.9x	0.77	x	5.2	x	8.86	x	0.63	x	0.7	=	14.09	(74)
East	0.9x	1	x	7.91	x	19.64	x	0.63	x	0.7	=	47.48	(76)
East	0.9x	1	x	7.91	x	38.42	x	0.63	x	0.7	=	92.88	(76)
East	0.9x	1	x	7.91	x	63.27	x	0.63	x	0.7	=	152.96	(76)
East	0.9x	1	x	7.91	x	92.28	x	0.63	x	0.7	=	223.08	(76)
East	0.9x	1	x	7.91	x	113.09	x	0.63	x	0.7	=	273.39	(76)
East	0.9x	1	x	7.91	x	115.77	x	0.63	x	0.7	=	279.86	(76)
East	0.9x	1	x	7.91	x	110.22	x	0.63	x	0.7	=	266.44	(76)
East	0.9x	1	x	7.91	x	94.68	x	0.63	x	0.7	=	228.87	(76)
East	0.9x	1	x	7.91	x	73.59	x	0.63	x	0.7	=	177.89	(76)
East	0.9x	1	x	7.91	x	45.59	x	0.63	x	0.7	=	110.21	(76)
East	0.9x	1	x	7.91	x	24.49	x	0.63	x	0.7	=	59.2	(76)
East	0.9x	1	x	7.91	x	16.15	x	0.63	x	0.7	=	39.04	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	84.95	164.48	274.63	418.52	536.67	561.71	529.58	437.64	324.19	195.44	105.42	70.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.46	598.89	694.98	816.13	911.11	913.85	867.24	781.38	679.62	573.83	510.21	494.95	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.83	0.64	0.48	0.55	0.83	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.76	19.91	20.19	20.56	20.84	20.97	20.99	20.99	20.89	20.51	20.07	19.74	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.96	19.96	19.96	19.97	19.98	19.99	19.99	19.99	19.98	19.98	19.97	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.78	0.55	0.37	0.44	0.75	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.31	18.53	18.93	19.46	19.83	19.97	19.98	19.98	19.89	19.4	18.77	18.28	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.89	19.09	19.43	19.9	20.23	20.37	20.39	20.39	20.29	19.84	19.29	18.86	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.89	19.09	19.43	19.9	20.23	20.37	20.39	20.39	20.29	19.84	19.29	18.86	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.79	0.59	0.42	0.48	0.78	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	519.47	594.13	679.81	756.17	724.15	537.78	362.38	378.11	529.67	551.36	506.26	493.48	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1446.19	1402.48	1275.63	1072.29	830.11	555.47	364.86	383.15	598.55	899.23	1191.25	1439.54	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	689.48	543.21	443.29	227.61	78.84	0	0	0	0	258.82	493.19	703.86	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3438.3 (98)

Space heating requirement in kWh/m²/year 39.92 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	689.48	543.21	443.29	227.61	78.84	0	0	0	0	258.82	493.19	703.86	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	737.41	580.98	474.11	243.43	84.32	0	0	0	0	276.81	527.48	752.79	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3677.33 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	201.92	177.93	186.78	167.31	163.86	146.28	140.36	154.2	153.98	173.49	183.61	197.02	
Efficiency of water heater												79.8	(216)
(217)m=	87.83	87.6	87.04	85.64	82.99	79.8	79.8	79.8	79.8	85.88	87.32	87.92	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	229.89	203.12	214.59	195.37	197.45	183.31	175.9	193.23	192.96	202.02	210.27	224.08	

Total = Sum(219a)$_{1...12}$ = 2422.18 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3677.33

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Water heating fuel used			2422.18	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			364.88	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	794.3	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	523.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1317.49	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.37	(268)
Total CO2, kg/year		sum of (265)…(271) =		1545.79	(272)

TER = 17.95 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-2-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.42	(1a) x	2.4	(2a) =	171.41	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.42	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.41	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Floor			71.42	x	0.11	=	7.8562			(28)
Walls Type1	28.74	10.12	18.62	x	0.18	=	3.35			(29)
Walls Type2	43.06	2.1	40.96	x	0.18	=	7.37			(29)
Total area of elements, m²			143.22							(31)
Party wall			14.79	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	32.69	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	13.68	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	46.37	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	74.65	74.65	74.65	74.65	74.65	74.65	74.65	74.65	74.65	74.65	74.65	74.65	

Average = Sum(39)$_{1…12}$ /12= 74.65 (39)

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Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	

Average = Sum(40)$_{1…12}$ /12= 1.05 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.28 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 88.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	97.19	93.65	90.12	86.59	83.05	79.52	79.52	83.05	86.59	90.12	93.65	97.19	

Total = Sum(44)$_{1…12}$ = 1060.23 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	144.13	126.05	130.08	113.4	108.81	93.9	87.01	99.85	101.04	117.75	128.53	139.58	

Total = Sum(45)$_{1…12}$ = 1390.13 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	21.62	18.91	19.51	17.01	16.32	14.08	13.05	14.98	15.16	17.66	19.28	20.94	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1.03 (52)

Temperature factor from Table 2b — 0.6 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) — 1.03 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.4	175.98	185.35	166.9	164.09	147.39	142.29	155.12	154.53	173.03	182.03	194.86	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.4	175.98	185.35	166.9	164.09	147.39	142.29	155.12	154.53	173.03	182.03	194.86	

Output from water heater (annual)$_{1...12}$ 2040.97 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.14	81.85	87.47	80.5	80.4	74.02	73.15	77.42	76.39	83.37	85.53	90.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114	114	114	114	114	114	114	114	114	114	114	114	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.61	16.53	13.44	10.18	7.61	6.42	6.94	9.02	12.11	15.37	17.94	19.13	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.59	202.67	197.42	186.26	172.16	158.91	150.06	147.98	153.23	164.39	178.49	191.74	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	(71)

Water heating gains (Table 5)

(72)m=	123.85	121.81	117.57	111.81	108.07	102.8	98.32	104.06	106.1	112.06	118.79	121.82	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	400.25	398.21	385.64	365.45	345.04	325.34	312.53	318.26	328.64	349.03	372.43	389.89	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)

East	0.9x	1	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	55.1	107.78	177.5	258.87	317.25	324.77	309.19	265.59	206.44	127.89	68.7	45.31	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	455.35	505.99	563.14	624.32	662.29	650.11	621.72	583.86	535.07	476.92	441.13	435.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.95	0.86	0.69	0.52	0.57	0.83	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.94	20.06	20.29	20.59	20.84	20.96	20.99	20.99	20.9	20.58	20.2	19.9	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.82	0.61	0.41	0.46	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.63	18.81	19.15	19.56	19.89	20.02	20.04	20.04	19.97	19.56	19.01	18.58	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.15	19.31	19.6	19.97	20.27	20.4	20.42	20.42	20.34	19.97	19.48	19.11	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.15	19.31	19.6	19.97	20.27	20.4	20.42	20.42	20.34	19.97	19.48	19.11	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.83	0.64	0.46	0.51	0.78	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	453.2	501.5	550.87	584.46	549.22	415.68	283.15	296.14	417.77	456.16	436.94	433.57	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1108.75	1075.94	978.27	826.55	639.46	432.83	285.42	300.13	466.02	699.27	924.45	1112.73	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	487.73	386.03	317.99	174.3	67.14	0	0	0	0	180.87	351.01	505.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2470.36 (98)

Space heating requirement in kWh/m²/year 34.59 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating	**kWh/year**
Annual space heating requirement	2470.36

DER WorkSheet: New dwelling design stage

Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1945.41	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	648.47	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2040.97	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1607.26	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	535.75	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	47.37	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.22	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	46.22	(331)
Energy for lighting (calculated in Appendix L)		328.7	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	5119.5	x	0.22		1105.81	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1638.24	x	0.52		-850.25	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4229.63	x	0.22		913.6	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1353.48	x	0.52		-702.46	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	275.05	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	24.58	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	766.34	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					766.34	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	23.99	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	170.6	(379)
Total CO2, kg/year	sum of (376)…(382) =					960.92	(383)

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Dwelling CO2 Emission Rate	(383) ÷ (4) =	13.45	(384)
EI rating (section 14)		88.94	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-2-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.42	(1a) x	2.4	(2a) =	171.41	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.42	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.41	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.43	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Floor			71.42	x	0.13	=	9.284599			(28)
Walls Type1	28.74	10.12	18.62	x	0.18	=	3.35			(29)
Walls Type2	43.06	2.1	40.96	x	0.18	=	7.37			(29)
Total area of elements, m²			143.22							(31)
Party wall			14.79	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.53 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.61 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 50.14 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.28	34.05	33.82	32.75	32.55	31.61	31.61	31.44	31.97	32.55	32.95	33.38	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	84.42	84.19	83.96	82.89	82.69	81.75	81.75	81.58	82.11	82.69	83.09	83.52	

Average = Sum(39)$_{1…12}$ /12= 82.89 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.18	1.18	1.18	1.16	1.16	1.14	1.14	1.14	1.15	1.16	1.16	1.17

Average = Sum(40)$_{1…12}$ /12= 1.16 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.28 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	97.19	93.65	90.12	86.59	83.05	79.52	79.52	83.05	86.59	90.12	93.65	97.19	
Total = Sum(44)$_{1…12}$ =												1060.23	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	144.13	126.05	130.08	113.4	108.81	93.9	87.01	99.85	101.04	117.75	128.53	139.58	
Total = Sum(45)$_{1…12}$ =												1390.13	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	21.62	18.91	19.51	17.01	16.32	14.08	13.05	14.98	15.16	17.66	19.28	20.94	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	190.72	168.14	176.67	158.5	155.41	138.99	133.61	146.44	146.13	164.34	173.63	186.17	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	190.72	168.14	176.67	158.5	155.41	138.99	133.61	146.44	146.13	164.34	173.63	186.17

Output from water heater (annual)$_{1...12}$ 1938.74 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.2	75.58	80.53	73.78	73.46	67.29	66.21	70.47	69.67	76.43	78.81	83.69	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114	114	114	114	114	114	114	114	114	114	114	114	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	19.13	17	13.82	10.46	7.82	6.6	7.14	9.27	12.45	15.81	18.45	19.67	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	200.59	202.67	197.42	186.26	172.16	158.91	150.06	147.98	153.23	164.39	178.49	191.74	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	(71)
Water heating gains (Table 5)													
(72)m=	114.51	112.47	108.23	102.47	98.73	93.46	88.99	94.72	96.76	102.73	109.46	112.48	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	394.44	392.34	379.68	359.4	338.92	319.18	306.39	312.18	322.64	343.13	366.6	384.09	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)

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East	0.9x	1	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	60.74	118.83	195.69	285.4	349.77	358.06	340.88	292.81	227.6	141	75.74	49.95	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	455.18	511.17	575.37	644.8	688.69	677.24	647.27	605	550.24	484.13	442.34	434.04	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.96	0.88	0.71	0.54	0.6	0.85	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.75	19.89	20.15	20.49	20.78	20.95	20.99	20.98	20.87	20.49	20.06	19.73	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.94	19.94	19.95	19.95	19.96	19.96	19.97	19.96	19.95	19.95	19.94	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.83	0.62	0.42	0.47	0.77	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.28	18.48	18.86	19.36	19.74	19.93	19.96	19.96	19.85	19.36	18.74	18.25	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.87	19.05	19.38	19.81	20.16	20.34	20.37	20.37	20.26	19.81	19.27	18.84	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.87	19.05	19.38	19.81	20.16	20.34	20.37	20.37	20.26	19.81	19.27	18.84	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.84	0.65	0.47	0.52	0.8	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	453.01	506.62	563.13	605.4	578.22	443.57	304.47	317.2	438.55	464.53	438.26	432.39	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1229.63	1191.04	1081.04	904.48	699.27	468.9	308.35	323.74	505.72	761.81	1011.22	1222.9	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	577.81	459.93	385.32	215.34	90.06	0	0	0	0	221.17	412.53	588.14	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2950.31 (98)

Space heating requirement in kWh/m²/year 41.31 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	577.81	459.93	385.32	215.34	90.06	0	0	0	0	221.17	412.53	588.14	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	617.98	491.9	412.11	230.31	96.32	0	0	0	0	236.55	441.21	629.03	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3155.41 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

190.72	168.14	176.67	158.5	155.41	138.99	133.61	146.44	146.13	164.34	173.63	186.17

Efficiency of water heater | 79.8 | (216)

(217)m=	87.59	87.36	86.84	85.63	83.42	79.8	79.8	79.8	79.8	85.61	87.04	87.67	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	217.75	192.46	203.45	185.09	186.3	174.17	167.42	183.51	183.12	191.98	199.47	212.35

Total = Sum(219a)$_{1...12}$ = | 2297.07 | (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3155.41	
Water heating fuel used		2297.07	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		337.92	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	681.57	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	496.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1177.74	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	175.38	(268)
Total CO2, kg/year		sum of (265)…(271) =		1392.04	(272)

TER = | 19.49 | (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-2-03

Address :	Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	53.01	(1a)	x	2.4	(2a)	=	127.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.01	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			127.22	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Floor			53.01	x	0.11	=	5.8311			(28)
Walls Type1	37.55	11.96	25.59	x	0.18	=	4.61			(29)
Walls Type2	25.99	2.1	23.89	x	0.18	=	4.3			(29)
Total area of elements, m²			116.55							(31)
Party wall			14.75	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.95 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.93 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 43.89 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.88	64.88	64.88	64.88	64.88	64.88	64.88	64.88	64.88	64.88	64.88	64.88	

Average = Sum(39)$_{1…12}$ /12= 64.88 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22

Average = Sum(40)$_{1…12}$ /12= 1.22 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.78 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 76.45 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	84.09	81.03	77.98	74.92	71.86	68.8	68.8	71.86	74.92	77.98	81.03	84.09

Total = Sum(44)$_{1…12}$ = 917.37 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	124.71	109.07	112.55	98.12	94.15	81.25	75.29	86.39	87.42	101.88	111.21	120.77

Total = Sum(45)$_{1…12}$ = 1202.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.71	16.36	16.88	14.72	14.12	12.19	11.29	12.96	13.11	15.28	16.68	18.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.98	159	167.83	151.62	149.43	134.74	130.56	141.67	140.92	157.16	164.71	176.05	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.98	159	167.83	151.62	149.43	134.74	130.56	141.67	140.92	157.16	164.71	176.05

Output from water heater (annual)$_{1...12}$ | 1853.66 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.69	76.21	81.64	75.42	75.53	69.81	69.25	72.95	71.86	78.1	79.77	84.38	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.82	12.28	9.98	7.56	5.65	4.77	5.15	6.7	8.99	11.42	13.33	14.21	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	155.04	156.65	152.6	143.97	133.07	122.83	115.99	114.38	118.44	127.07	137.96	148.2	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	(71)

Water heating gains (Table 5)

(72)m=	115.17	113.4	109.74	104.75	101.51	96.96	93.08	98.05	99.81	104.97	110.8	113.41	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	333.72	332.02	322	305.96	289.92	274.24	263.91	268.81	276.92	293.14	311.77	325.5	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)

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East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)

South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	113.51	195.48	270.93	337.99	378.11	374.49	361.47	332.12	294.49	217.19	136.4	96.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	447.23	527.49	592.93	643.95	668.03	648.73	625.38	600.93	571.41	510.33	448.17	422.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.78	0.61	0.45	0.49	0.71	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.88	20.08	20.35	20.64	20.86	20.97	20.99	20.99	20.93	20.64	20.19	19.83	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.94	0.87	0.72	0.52	0.34	0.38	0.63	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.44	18.73	19.11	19.5	19.77	19.88	19.9	19.9	19.85	19.52	18.89	18.36	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.16	19.4	19.73	20.07	20.32	20.42	20.45	20.44	20.39	20.08	19.54	19.1	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.16	19.4	19.73	20.07	20.32	20.42	20.45	20.44	20.39	20.08	19.54	19.1	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.87	0.75	0.56	0.4	0.43	0.67	0.89	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	441.08	512.4	557.48	561.57	498.51	365.39	247.68	259.55	380.94	456.41	435.81	417.76	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	964.18	940.87	858.11	724.72	559.01	377.83	249.54	262.38	408.16	614.99	807.3	966.46	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	389.19	287.93	223.67	117.47	45.01	0	0	0	0	117.98	267.47	408.23	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 1856.97 (98)

Space heating requirement in kWh/m²/year 35.03 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1856.97	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1462.36	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	487.45	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1853.66	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1459.76	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	486.59	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	38.96	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		34.3	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	34.3	(331)
Energy for lighting (calculated in Appendix L)		244.11	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	3848.33	x	0.22	831.24	(363)

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less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1231.46	x	0.52		-639.13	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	3841.47	x	0.22		829.76	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1229.27	x	0.52		-637.99	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	226.23	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	20.22	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	630.32	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					630.32	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	17.8	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	126.69	(379)
Total CO2, kg/year	sum of (376)…(382) =					774.82	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					14.62	(384)
EI rating (section 14)						89.41	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-2-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.01	(1a) x	2.4	(2a) =	127.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.01	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	127.22	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.29	x1/[1/(1.4)+ 0.04]		=	5.69			(27)
Windows Type 2			2.57	x1/[1/(1.4)+ 0.04]		=	3.41			(27)
Windows Type 3			2.57	x1/[1/(1.4)+ 0.04]		=	3.41			(27)
Windows Type 4			1.72	x1/[1/(1.4)+ 0.04]		=	2.28			(27)
Floor			53.01	x	0.13	=	6.8913			(28)
Walls Type1	37.55	11.15	26.4	x	0.18	=	4.75			(29)
Walls Type2	25.99	2.1	23.89	x	0.18	=	4.3			(29)
Total area of elements, m²			116.55							(31)
Party wall			14.75	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.83 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 13.77 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 46.59 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	25.08	24.92	24.77	24.03	23.9	23.26	23.26	23.14	23.51	23.9	24.17	24.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	71.67	71.51	71.36	70.63	70.49	69.85	69.85	69.74	70.1	70.49	70.77	71.06	

Average = Sum(39)$_{1...12}$ /12= 70.63 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.35	1.35	1.35	1.33	1.33	1.32	1.32	1.32	1.32	1.33	1.33	1.34	

Average = Sum(40)$_{1...12}$ /12= 1.33 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.78 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 76.45 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	84.09	81.03	77.98	74.92	71.86	68.8	68.8	71.86	74.92	77.98	81.03	84.09	

Total = Sum(44)$_{1...12}$ = 917.37 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	124.71	109.07	112.55	98.12	94.15	81.25	75.29	86.39	87.42	101.88	111.21	120.77	

Total = Sum(45)$_{1...12}$ = 1202.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.71	16.36	16.88	14.72	14.12	12.19	11.29	12.96	13.11	15.28	16.68	18.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	171.3	151.16	159.14	143.22	140.75	126.34	121.88	132.99	132.52	148.48	156.31	167.37	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	171.3	151.16	159.14	143.22	140.75	126.34	121.88	132.99	132.52	148.48	156.31	167.37	

Output from water heater (annual)$_{1...12}$	1751.44	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	78.74	69.93	74.7	68.7	68.58	63.09	62.31	66	65.14	71.15	73.05	77.43	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.86	12.31	10.01	7.58	5.67	4.78	5.17	6.72	9.02	11.45	13.36	14.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	155.04	156.65	152.6	143.97	133.07	122.83	115.99	114.38	118.44	127.07	137.96	148.2	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	(71)

Water heating gains (Table 5)

(72)m=	105.83	104.07	100.4	95.42	92.18	87.62	83.75	88.71	90.47	95.64	101.46	104.08	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	327.42	325.71	315.69	299.64	283.6	267.92	257.59	262.49	270.61	286.83	305.47	319.21	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.57	x	19.64	x	0.63	x	0.7	=	15.43	(76)
East	0.9x	1	x	2.57	x	19.64	x	0.63	x	0.7	=	15.43	(76)

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East	0.9x	1	x	2.57	x	38.42	x	0.63	x	0.7	=	30.18	(76)
East	0.9x	1	x	2.57	x	38.42	x	0.63	x	0.7	=	30.18	(76)
East	0.9x	1	x	2.57	x	63.27	x	0.63	x	0.7	=	49.7	(76)
East	0.9x	1	x	2.57	x	63.27	x	0.63	x	0.7	=	49.7	(76)
East	0.9x	1	x	2.57	x	92.28	x	0.63	x	0.7	=	72.48	(76)
East	0.9x	1	x	2.57	x	92.28	x	0.63	x	0.7	=	72.48	(76)
East	0.9x	1	x	2.57	x	113.09	x	0.63	x	0.7	=	88.83	(76)
East	0.9x	1	x	2.57	x	113.09	x	0.63	x	0.7	=	88.83	(76)
East	0.9x	1	x	2.57	x	115.77	x	0.63	x	0.7	=	90.93	(76)
East	0.9x	1	x	2.57	x	115.77	x	0.63	x	0.7	=	90.93	(76)
East	0.9x	1	x	2.57	x	110.22	x	0.63	x	0.7	=	86.57	(76)
East	0.9x	1	x	2.57	x	110.22	x	0.63	x	0.7	=	86.57	(76)
East	0.9x	1	x	2.57	x	94.68	x	0.63	x	0.7	=	74.36	(76)
East	0.9x	1	x	2.57	x	94.68	x	0.63	x	0.7	=	74.36	(76)
East	0.9x	1	x	2.57	x	73.59	x	0.63	x	0.7	=	57.8	(76)
East	0.9x	1	x	2.57	x	73.59	x	0.63	x	0.7	=	57.8	(76)
East	0.9x	1	x	2.57	x	45.59	x	0.63	x	0.7	=	35.81	(76)
East	0.9x	1	x	2.57	x	45.59	x	0.63	x	0.7	=	35.81	(76)
East	0.9x	1	x	2.57	x	24.49	x	0.63	x	0.7	=	19.23	(76)
East	0.9x	1	x	2.57	x	24.49	x	0.63	x	0.7	=	19.23	(76)
East	0.9x	1	x	2.57	x	16.15	x	0.63	x	0.7	=	12.69	(76)
East	0.9x	1	x	2.57	x	16.15	x	0.63	x	0.7	=	12.69	(76)
South	0.9x	0.77	x	4.29	x	46.75	x	0.63	x	0.7	=	61.3	(78)
South	0.9x	0.77	x	1.72	x	46.75	x	0.63	x	0.7	=	24.58	(78)
South	0.9x	0.77	x	4.29	x	76.57	x	0.63	x	0.7	=	100.39	(78)
South	0.9x	0.77	x	1.72	x	76.57	x	0.63	x	0.7	=	40.25	(78)
South	0.9x	0.77	x	4.29	x	97.53	x	0.63	x	0.7	=	127.87	(78)
South	0.9x	0.77	x	1.72	x	97.53	x	0.63	x	0.7	=	51.27	(78)
South	0.9x	0.77	x	4.29	x	110.23	x	0.63	x	0.7	=	144.53	(78)
South	0.9x	0.77	x	1.72	x	110.23	x	0.63	x	0.7	=	57.95	(78)
South	0.9x	0.77	x	4.29	x	114.87	x	0.63	x	0.7	=	150.61	(78)
South	0.9x	0.77	x	1.72	x	114.87	x	0.63	x	0.7	=	60.38	(78)
South	0.9x	0.77	x	4.29	x	110.55	x	0.63	x	0.7	=	144.94	(78)
South	0.9x	0.77	x	1.72	x	110.55	x	0.63	x	0.7	=	58.11	(78)
South	0.9x	0.77	x	4.29	x	108.01	x	0.63	x	0.7	=	141.61	(78)
South	0.9x	0.77	x	1.72	x	108.01	x	0.63	x	0.7	=	56.78	(78)
South	0.9x	0.77	x	4.29	x	104.89	x	0.63	x	0.7	=	137.53	(78)
South	0.9x	0.77	x	1.72	x	104.89	x	0.63	x	0.7	=	55.14	(78)
South	0.9x	0.77	x	4.29	x	101.89	x	0.63	x	0.7	=	133.58	(78)
South	0.9x	0.77	x	1.72	x	101.89	x	0.63	x	0.7	=	53.56	(78)
South	0.9x	0.77	x	4.29	x	82.59	x	0.63	x	0.7	=	108.28	(78)

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South	0.9x	0.77	x	1.72	x	82.59	x	0.63	x	0.7	=	43.41	(78)
South	0.9x	0.77	x	4.29	x	55.42	x	0.63	x	0.7	=	72.66	(78)
South	0.9x	0.77	x	1.72	x	55.42	x	0.63	x	0.7	=	29.13	(78)
South	0.9x	0.77	x	4.29	x	40.4	x	0.63	x	0.7	=	52.97	(78)
South	0.9x	0.77	x	1.72	x	40.4	x	0.63	x	0.7	=	21.24	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	116.72	200.99	278.54	347.43	388.64	384.91	371.53	341.39	302.73	223.3	140.26	99.57	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	444.14	526.7	594.23	647.07	672.24	652.82	629.12	603.88	573.34	510.13	445.72	418.78	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.91	0.81	0.64	0.48	0.52	0.74	0.93	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.71	19.92	20.21	20.54	20.81	20.95	20.99	20.98	20.9	20.56	20.07	19.67	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.8	19.8	19.8	19.82	19.82	19.83	19.83	19.83	19.82	19.82	19.81	19.81	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.88	0.75	0.54	0.36	0.39	0.65	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.12	18.42	18.84	19.31	19.64	19.8	19.82	19.82	19.75	19.34	18.65	18.07	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.91	19.17	19.52	19.93	20.22	20.37	20.41	20.4	20.33	19.95	19.36	18.87	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.91	19.17	19.52	19.93	20.22	20.37	20.41	20.4	20.33	19.95	19.36	18.87	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.95	0.88	0.77	0.59	0.42	0.45	0.69	0.9	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	438.34	512.72	561.97	572.16	516.89	384.43	262.72	274.56	397.2	461.63	434.36	414.43	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1047.42	1020.5	929.36	778.89	600.83	403.29	265.89	279.23	436.49	658.98	867.43	1042.35	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	453.16	341.22	273.34	148.85	62.45	0	0	0	0	146.83	311.81	467.17	

Total per year (kWh/year) = $\mathrm{Sum}(98)_{1...5,9...12}$ = 2204.82 (98)

Space heating requirement in kWh/m²/year 41.59 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	453.16	341.22	273.34	148.85	62.45	0	0	0	0	146.83	311.81	467.17		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	484.66	364.94	292.34	159.2	66.79	0	0	0	0	157.04	333.48	499.64		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2358.1	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	171.3	151.16	159.14	143.22	140.75	126.34	121.88	132.99	132.52	148.48	156.31	167.37		
Efficiency of water heater													79.8	(216)
(217)m=	87.29	86.92	86.24	84.92	82.81	79.8	79.8	79.8	79.8	84.78	86.62	87.41		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	196.25	173.9	184.53	168.65	169.97	158.32	152.73	166.65	166.06	175.13	180.45	191.48		
Total = Sum(219a)$_{1...12}$ =													2084.1	(219)

Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			2358.1	
Water heating fuel used			2084.1	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			244.75	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	509.35	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	450.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =			959.51	(265)

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Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	127.02	(268)
Total CO2, kg/year			sum of (265)…(271) =		1125.46	(272)

TER =	21.23	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-2-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	79.03	(1a) x	2.4	(2a) =	189.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.03	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	189.67	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Floor			79.03	x	0.11	=	8.6933			(28)
Walls Type1	42.8	18.86	23.94	x	0.18	=	4.31			(29)
Walls Type2	13.9	2.1	11.8	x	0.18	=	2.12			(29)
Total area of elements, m²			135.73							(31)
Party wall			39.79	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	39.24	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		15.29	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	54.53	(37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	85.83	85.83	85.83	85.83	85.83	85.83	85.83	85.83	85.83	85.83	85.83	85.83	

Average = $Sum(39)_{1…12}$ /12= 85.83 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	

Average = $Sum(40)_{1…12}$ /12= 1.09 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.44 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	101.47	97.78	94.09	90.4	86.71	83.02	83.02	86.71	90.4	94.09	97.78	101.47	

Total = $Sum(44)_{1…12}$ = 1107 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150.48	131.61	135.81	118.41	113.61	98.04	90.85	104.25	105.49	122.94	134.2	145.74	

Total = $Sum(45)_{1…12}$ = 1451.45 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.57	19.74	20.37	17.76	17.04	14.71	13.63	15.64	15.82	18.44	20.13	21.86	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.76	181.54	191.09	171.9	168.89	151.53	146.13	159.53	158.99	178.22	187.7	201.01	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.76	181.54	191.09	171.9	168.89	151.53	146.13	159.53	158.99	178.22	187.7	201.01

Output from water heater (annual)$_{1…12}$ | 2102.29 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	94.26	83.7	89.38	82.16	82	75.39	74.43	78.88	77.87	85.1	87.42	92.68	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.38	17.21	14	10.6	7.92	6.69	7.23	9.39	12.61	16.01	18.69	19.92	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	217.4	219.66	213.97	201.87	186.59	172.23	162.64	160.39	166.07	178.17	193.45	207.81	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	(71)

Water heating gains (Table 5)

(72)m=	126.69	124.56	120.13	114.12	110.21	104.71	100.04	106.03	108.16	114.38	121.41	124.57	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	423.14	421.09	407.77	386.25	364.39	343.3	329.57	335.47	346.5	368.23	393.21	411.96	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	5.29	x	46.75	x	0.5	x	0.8	=	68.56	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	5.29	x	76.57	x	0.5	x	0.8	=	112.28	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	5.29	x	97.53	x	0.5	x	0.8	=	143.02	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	5.29	x	110.23	x	0.5	x	0.8	=	161.65	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	5.29	x	114.87	x	0.5	x	0.8	=	168.45	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	5.29	x	110.55	x	0.5	x	0.8	=	162.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	5.29	x	108.01	x	0.5	x	0.8	=	158.39	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	5.29	x	104.89	x	0.5	x	0.8	=	153.82	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	5.29	x	101.89	x	0.5	x	0.8	=	149.4	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	5.29	x	82.59	x	0.5	x	0.8	=	121.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	5.29	x	55.42	x	0.5	x	0.8	=	81.26	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	5.29	x	40.4	x	0.5	x	0.8	=	59.24	(78)
West	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(80)

West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	183.92	315.17	433.45	536.24	596.58	589.6	569.61	525.59	469.52	349.2	220.71	157.09	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	607.06	736.27	841.22	922.49	960.97	932.9	899.18	861.06	816.01	717.43	613.92	569.06	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.89	0.75	0.57	0.42	0.45	0.68	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.21	20.47	20.73	20.91	20.98	21	21	20.96	20.72	20.29	19.95	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.85	0.7	0.49	0.33	0.36	0.6	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.7	19	19.36	19.72	19.93	20	20.01	20.01	19.98	19.71	19.12	18.62	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.22	19.48	19.81	20.13	20.32	20.39	20.41	20.4	20.37	20.11	19.59	19.15	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.22	19.48	19.81	20.13	20.32	20.39	20.41	20.4	20.37	20.11	19.59	19.15	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.86	0.71	0.52	0.36	0.4	0.63	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	600.71	716.98	789.22	791.5	686.68	488.64	325.61	342.05	516.23	638.03	599.52	564.64	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1280.46	1251.39	1142.04	963.43	740.14	497.28	326.62	343.7	538.39	816.39	1071.86	1283.09	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	505.73	359.12	262.5	123.79	39.77	0	0	0	0	132.7	340.09	534.53	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2298.22 (98)

Space heating requirement in kWh/m²/year 29.08 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2298.22	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1809.85	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	603.28	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2102.29	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1655.55	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	551.85	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	46.21	(313)

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Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		51.14	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	51.14	(331)
Energy for lighting (calculated in Appendix L)		342.28	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4762.77	x	0.22		1028.76	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1524.09	x	0.52		-791	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4356.71	x	0.22		941.05	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1394.15	x	0.52		-723.56	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	268.29	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	23.98	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	747.51	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					747.51	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	26.54	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	177.64	(379)
Total CO2, kg/year	sum of (376)…(382) =					951.7	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					12.04	(384)
EI rating (section 14)						89.72	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-2-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	79.03	(1a) x	2.4	(2a) =	189.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.03	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	189.67	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) = 0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.43	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.58	x1/[1/(1.4)+ 0.04]		=	3.42			(27)
Windows Type 2			2.58	x1/[1/(1.4)+ 0.04]		=	3.42			(27)
Windows Type 3			4.95	x1/[1/(1.4)+ 0.04]		=	6.56			(27)
Windows Type 4			2.58	x1/[1/(1.4)+ 0.04]		=	3.42			(27)
Windows Type 5			4.95	x1/[1/(1.4)+ 0.04]		=	6.56			(27)
Floor			79.03	x	0.13	=	10.2739			(28)
Walls Type1	42.8	17.64	25.16	x	0.18	=	4.53			(29)
Walls Type2	13.9	2.1	11.8	x	0.18	=	2.12			(29)
Total area of elements, m²			135.73							(31)
Party wall			39.79	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	42.41	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.54 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 57.95 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	37.42	37.18	36.95	35.85	35.65	34.7	34.7	34.52	35.06	35.65	36.06	36.5	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	95.37	95.13	94.9	93.81	93.6	92.65	92.65	92.47	93.02	93.6	94.02	94.45	

Average = Sum(39)$_{1…12}$ /12= 93.81 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.21	1.2	1.2	1.19	1.18	1.17	1.17	1.17	1.18	1.18	1.19	1.2	

Average = Sum(40)$_{1…12}$ /12= 1.19 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.44 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	101.47	97.78	94.09	90.4	86.71	83.02	83.02	86.71	90.4	94.09	97.78	101.47	

Total = Sum(44)$_{1…12}$ = 1107 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150.48	131.61	135.81	118.41	113.61	98.04	90.85	104.25	105.49	122.94	134.2	145.74	

Total = Sum(45)$_{1…12}$ = 1451.45 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.57	19.74	20.37	17.76	17.04	14.71	13.63	15.64	15.82	18.44	20.13	21.86	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	197.08	173.7	182.41	163.5	160.21	143.13	137.44	150.84	150.59	169.54	179.29	192.33	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	197.08	173.7	182.41	163.5	160.21	143.13	137.44	150.84	150.59	169.54	179.29	192.33

Output from water heater (annual)$_{1...12}$ — 2000.06 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	87.31	77.43	82.43	75.44	75.05	68.67	67.48	71.94	71.15	78.15	80.7	85.73	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.38	17.21	14	10.6	7.92	6.69	7.23	9.39	12.61	16.01	18.69	19.92	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	217.4	219.66	213.97	201.87	186.59	172.23	162.64	160.39	166.07	178.17	193.45	207.81	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	(71)

Water heating gains (Table 5)

(72)m=	117.35	115.22	110.8	104.78	100.88	95.38	90.7	96.69	98.82	105.05	112.08	115.23	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	416.8	414.76	401.43	379.91	358.05	336.96	323.23	329.14	340.16	361.89	386.88	405.62	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	2.58	x	46.75	x	0.63	x	0.7	=	36.86	(78)
South	0.9x	0.77	x	2.58	x	46.75	x	0.63	x	0.7	=	36.86	(78)
South	0.9x	0.77	x	4.95	x	46.75	x	0.63	x	0.7	=	70.73	(78)
South	0.9x	0.77	x	2.58	x	76.57	x	0.63	x	0.7	=	60.37	(78)
South	0.9x	0.77	x	2.58	x	76.57	x	0.63	x	0.7	=	60.37	(78)
South	0.9x	0.77	x	4.95	x	76.57	x	0.63	x	0.7	=	115.83	(78)
South	0.9x	0.77	x	2.58	x	97.53	x	0.63	x	0.7	=	76.9	(78)
South	0.9x	0.77	x	2.58	x	97.53	x	0.63	x	0.7	=	76.9	(78)
South	0.9x	0.77	x	4.95	x	97.53	x	0.63	x	0.7	=	147.55	(78)
South	0.9x	0.77	x	2.58	x	110.23	x	0.63	x	0.7	=	86.92	(78)
South	0.9x	0.77	x	2.58	x	110.23	x	0.63	x	0.7	=	86.92	(78)
South	0.9x	0.77	x	4.95	x	110.23	x	0.63	x	0.7	=	166.76	(78)
South	0.9x	0.77	x	2.58	x	114.87	x	0.63	x	0.7	=	90.57	(78)
South	0.9x	0.77	x	2.58	x	114.87	x	0.63	x	0.7	=	90.57	(78)
South	0.9x	0.77	x	4.95	x	114.87	x	0.63	x	0.7	=	173.78	(78)
South	0.9x	0.77	x	2.58	x	110.55	x	0.63	x	0.7	=	87.16	(78)
South	0.9x	0.77	x	2.58	x	110.55	x	0.63	x	0.7	=	87.16	(78)
South	0.9x	0.77	x	4.95	x	110.55	x	0.63	x	0.7	=	167.23	(78)
South	0.9x	0.77	x	2.58	x	108.01	x	0.63	x	0.7	=	85.17	(78)
South	0.9x	0.77	x	2.58	x	108.01	x	0.63	x	0.7	=	85.17	(78)
South	0.9x	0.77	x	4.95	x	108.01	x	0.63	x	0.7	=	163.4	(78)
South	0.9x	0.77	x	2.58	x	104.89	x	0.63	x	0.7	=	82.71	(78)
South	0.9x	0.77	x	2.58	x	104.89	x	0.63	x	0.7	=	82.71	(78)
South	0.9x	0.77	x	4.95	x	104.89	x	0.63	x	0.7	=	158.68	(78)
South	0.9x	0.77	x	2.58	x	101.89	x	0.63	x	0.7	=	80.33	(78)
South	0.9x	0.77	x	2.58	x	101.89	x	0.63	x	0.7	=	80.33	(78)
South	0.9x	0.77	x	4.95	x	101.89	x	0.63	x	0.7	=	154.13	(78)
South	0.9x	0.77	x	2.58	x	82.59	x	0.63	x	0.7	=	65.12	(78)
South	0.9x	0.77	x	2.58	x	82.59	x	0.63	x	0.7	=	65.12	(78)
South	0.9x	0.77	x	4.95	x	82.59	x	0.63	x	0.7	=	124.93	(78)
South	0.9x	0.77	x	2.58	x	55.42	x	0.63	x	0.7	=	43.7	(78)
South	0.9x	0.77	x	2.58	x	55.42	x	0.63	x	0.7	=	43.7	(78)
South	0.9x	0.77	x	4.95	x	55.42	x	0.63	x	0.7	=	83.83	(78)
South	0.9x	0.77	x	2.58	x	40.4	x	0.63	x	0.7	=	31.85	(78)
South	0.9x	0.77	x	2.58	x	40.4	x	0.63	x	0.7	=	31.85	(78)
South	0.9x	0.77	x	4.95	x	40.4	x	0.63	x	0.7	=	61.11	(78)
West	0.9x	0.77	x	4.95	x	19.64	x	0.63	x	0.7	=	29.71	(80)
West	0.9x	0.77	x	2.58	x	19.64	x	0.63	x	0.7	=	15.49	(80)
West	0.9x	0.77	x	4.95	x	38.42	x	0.63	x	0.7	=	58.12	(80)
West	0.9x	0.77	x	2.58	x	38.42	x	0.63	x	0.7	=	30.29	(80)
West	0.9x	0.77	x	4.95	x	63.27	x	0.63	x	0.7	=	95.72	(80)

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West	0.9x	0.77	x	2.58	x	63.27	x	0.63	x	0.7	=	49.89	(80)
West	0.9x	0.77	x	4.95	x	92.28	x	0.63	x	0.7	=	139.6	(80)
West	0.9x	0.77	x	2.58	x	92.28	x	0.63	x	0.7	=	72.76	(80)
West	0.9x	0.77	x	4.95	x	113.09	x	0.63	x	0.7	=	171.08	(80)
West	0.9x	0.77	x	2.58	x	113.09	x	0.63	x	0.7	=	89.17	(80)
West	0.9x	0.77	x	4.95	x	115.77	x	0.63	x	0.7	=	175.14	(80)
West	0.9x	0.77	x	2.58	x	115.77	x	0.63	x	0.7	=	91.28	(80)
West	0.9x	0.77	x	4.95	x	110.22	x	0.63	x	0.7	=	166.74	(80)
West	0.9x	0.77	x	2.58	x	110.22	x	0.63	x	0.7	=	86.91	(80)
West	0.9x	0.77	x	4.95	x	94.68	x	0.63	x	0.7	=	143.22	(80)
West	0.9x	0.77	x	2.58	x	94.68	x	0.63	x	0.7	=	74.65	(80)
West	0.9x	0.77	x	4.95	x	73.59	x	0.63	x	0.7	=	111.32	(80)
West	0.9x	0.77	x	2.58	x	73.59	x	0.63	x	0.7	=	58.02	(80)
West	0.9x	0.77	x	4.95	x	45.59	x	0.63	x	0.7	=	68.97	(80)
West	0.9x	0.77	x	2.58	x	45.59	x	0.63	x	0.7	=	35.95	(80)
West	0.9x	0.77	x	4.95	x	24.49	x	0.63	x	0.7	=	37.05	(80)
West	0.9x	0.77	x	2.58	x	24.49	x	0.63	x	0.7	=	19.31	(80)
West	0.9x	0.77	x	4.95	x	16.15	x	0.63	x	0.7	=	24.43	(80)
West	0.9x	0.77	x	2.58	x	16.15	x	0.63	x	0.7	=	12.73	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	189.65	324.99	446.96	552.96	615.18	607.98	587.37	541.97	484.15	360.08	227.58	161.99	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	606.45	739.75	848.4	932.87	973.23	944.95	910.61	871.11	824.31	721.97	614.46	567.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.78	0.6	0.44	0.48	0.71	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.84	20.05	20.34	20.65	20.87	20.97	20.99	20.99	20.94	20.64	20.17	19.8	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.91	19.92	19.92	19.93	19.93	19.94	19.94	19.94	19.94	19.93	19.93	19.92	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.87	0.72	0.51	0.34	0.37	0.63	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.39	18.7	19.11	19.55	19.81	19.93	19.94	19.94	19.89	19.54	18.89	18.33	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.97	19.24	19.6	19.99	20.24	20.34	20.36	20.36	20.31	19.98	19.4	18.92	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.97	19.24	19.6	19.99	20.24	20.34	20.36	20.36	20.31	19.98	19.4	18.92	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.94	0.87	0.74	0.55	0.38	0.42	0.66	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	600.37	721.82	801.25	813.77	720.12	518.15	346.7	363.43	543.66	650.4	601.08	563.32	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1398.7	1364.61	1243.46	1040.13	799.05	532.17	348.57	366.35	577.71	878.3	1156.51	1390.2	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	593.96	431.95	329	162.98	58.73	0	0	0	0	169.56	399.91	615.19	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2761.29 (98)

Space heating requirement in kWh/m²/year 34.94 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	593.96	431.95	329	162.98	58.73	0	0	0	0	169.56	399.91	615.19	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	635.25	461.98	351.88	174.31	62.81	0	0	0	0	181.35	427.71	657.96	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2953.25 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)													
	197.08	173.7	182.41	163.5	160.21	143.13	137.44	150.84	150.59	169.54	179.29	192.33	
Efficiency of water heater												79.8	(216)
(217)m=	87.57	87.15	86.37	84.81	82.41	79.8	79.8	79.8	79.8	84.81	86.89	87.7	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	225.04	199.31	211.2	192.79	194.4	179.36	172.23	189.03	188.71	199.89	206.34	219.31	

Total = Sum(219a)$_{1...12}$ = 2377.61 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2953.25

TER WorkSheet: New dwelling design stage

Water heating fuel used			2377.61	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			342.28	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	637.9	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	513.56	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1151.47	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	177.64	(268)
Total CO2, kg/year		sum of (265)…(271) =		1368.03	(272)

TER = 17.31 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-2-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	105.24	(1a) x	2.4	(2a) =	252.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	105.24	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	252.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 5			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Floor			105.24	x	0.11	=	11.5764			(28)
Walls Type1	30.46	12.88	17.58	x	0.18	=	3.16			(29)
Walls Type2	29.12	2.1	27.02	x	0.18	=	4.86			(29)
Total area of elements, m²			164.82							(31)
Party wall			42.26	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	36.87	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		15.67	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	52.54	(37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.21	94.21	94.21	94.21	94.21	94.21	94.21	94.21	94.21	94.21	94.21	94.21	

Average = Sum(39)$_{1...12}$ /12= 94.21 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	

Average = Sum(40)$_{1...12}$ /12= 0.9 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.78 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 100.3 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	110.33	106.31	102.3	98.29	94.28	90.27	90.27	94.28	98.29	102.3	106.31	110.33	

Total = Sum(44)$_{1...12}$ = 1203.56 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	163.61	143.1	147.66	128.73	123.52	106.59	98.77	113.34	114.7	133.67	145.91	158.45	

Total = Sum(45)$_{1...12}$ = 1578.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.54	21.46	22.15	19.31	18.53	15.99	14.82	17	17.2	20.05	21.89	23.77	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	218.89	193.02	202.94	182.23	178.8	160.09	154.05	168.62	168.19	188.95	199.4	213.73	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	218.89	193.02	202.94	182.23	178.8	160.09	154.05	168.62	168.19	188.95	199.4	213.73

Output from water heater (annual)1…12 — 2228.9 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	98.62	87.52	93.32	85.6	85.29	78.24	77.06	81.91	80.93	88.67	91.31	96.91	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.31	22.48	18.28	13.84	10.34	8.73	9.44	12.27	16.46	20.9	24.4	26.01	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	264.53	267.28	260.36	245.63	227.04	209.57	197.9	195.16	202.07	216.8	235.39	252.86	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	(71)

Water heating gains (Table 5)

(72)m=	132.56	130.24	125.43	118.89	114.64	108.66	103.58	110.09	112.41	119.18	126.82	130.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	487.14	484.74	468.81	443.1	416.77	391.71	375.66	382.26	395.69	421.62	451.35	473.86	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)

West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	70.12	137.17	225.91	329.47	403.78	413.34	393.52	338.02	262.74	162.77	87.43	57.67	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	557.26	621.91	694.72	772.58	820.55	805.05	769.18	720.28	658.43	584.39	538.79	531.53	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.89	0.71	0.53	0.59	0.86	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.05	20.16	20.37	20.63	20.86	20.97	21	20.99	20.92	20.62	20.28	20.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.96	0.85	0.64	0.44	0.49	0.79	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.88	19.05	19.35	19.73	20.03	20.15	20.17	20.17	20.1	19.72	19.22	18.84	(90)

fLA = Living area ÷ (4) = | 0.3 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.23	19.38	19.65	20	20.28	20.4	20.42	20.42	20.35	19.99	19.54	19.19	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.23	19.38	19.65	20	20.28	20.4	20.42	20.42	20.35	19.99	19.54	19.19	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.95	0.85	0.66	0.47	0.52	0.81	0.97	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	556.15	619.25	686	737.43	700.8	529.22	357.92	374.92	532.06	568.2	536.37	530.73	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1406.98	1364.48	1239.29	1045.87	808.41	546.33	359.69	378.33	588.65	884.44	1171.73	1412.32	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	633.01	500.79	411.64	222.07	80.06	0	0	0	0	235.28	457.46	655.9	

Total per year (kWh/year) = Sum(98)1...5,9...12 =	3196.23	(98)
Space heating requirement in kWh/m²/year	30.37	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		3196.23	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	2517.03	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	839.01	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2228.9	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1755.26	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	585.09	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	56.96	(313)

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Cooling System Energy Efficiency Ratio					0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =				0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside					68.1	(330a)
warm air heating system fans					0	(330b)
pump for solar water heating					0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =				68.1	(331)
Energy for lighting (calculated in Appendix L)					446.9	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
Space heating from CHP)	(307a) × 100 ÷ (362) =	6623.76	x	0.22		1430.73	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	2119.6	x	0.52		-1100.07	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4619.1	x	0.22		997.73	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1478.11	x	0.52		-767.14	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	330.76	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	29.56	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	921.57	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					921.57	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	35.34	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	231.94	(379)
Total CO2, kg/year	sum of (376)…(382) =					1188.85	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					11.3	(384)
EI rating (section 14)						89.4	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-2-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	105.24	(1a) x	2.4	(2a) =	252.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	105.24	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	252.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.43	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 3			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 4			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 5			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Floor			105.24	x	0.13	=	13.6812			(28)
Walls Type1	30.46	12.88	17.58	x	0.18	=	3.16			(29)
Walls Type2	29.12	2.1	27.02	x	0.18	=	4.86			(29)
Total area of elements, m²			164.82							(31)
Party wall			42.26	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.88 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.9 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 56.78 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	49.84	49.52	49.21	47.75	47.48	46.21	46.21	45.97	46.7	47.48	48.03	48.61	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	106.62	106.3	105.99	104.53	104.26	102.99	102.99	102.76	103.48	104.26	104.81	105.39	

Average = Sum(39)$_{1…12}$ /12= 104.53 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.01	1.01	1.01	0.99	0.99	0.98	0.98	0.98	0.98	0.99	1	1	

Average = Sum(40)$_{1…12}$ /12= 0.99 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.78 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 100.3 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	110.33	106.31	102.3	98.29	94.28	90.27	90.27	94.28	98.29	102.3	106.31	110.33	

Total = Sum(44)$_{1…12}$ = 1203.56 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	163.61	143.1	147.66	128.73	123.52	106.59	98.77	113.34	114.7	133.67	145.91	158.45	

Total = Sum(45)$_{1…12}$ = 1578.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.54	21.46	22.15	19.31	18.53	15.99	14.82	17	17.2	20.05	21.89	23.77	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.21	185.18	194.26	173.83	170.12	151.68	145.37	159.94	159.79	180.26	191	205.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	210.21	185.18	194.26	173.83	170.12	151.68	145.37	159.94	159.79	180.26	191	205.04

Output from water heater (annual)$_{1...12}$ | 2126.68 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.68	81.25	86.37	78.88	78.35	71.52	70.12	74.96	74.21	81.72	84.59	89.96	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	26.06	23.15	18.83	14.25	10.65	8.99	9.72	12.63	16.96	21.53	25.13	26.79	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	264.53	267.28	260.36	245.63	227.04	209.57	197.9	195.16	202.07	216.8	235.39	252.86	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	(71)

Water heating gains (Table 5)

(72)m=	123.22	120.9	116.09	109.55	105.31	99.33	94.24	100.76	103.07	109.84	117.48	120.91	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	481.56	479.07	463.02	437.18	410.75	385.64	369.61	376.29	389.84	415.91	445.75	468.31	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)

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West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	77.31	151.23	249.06	363.24	445.17	455.71	433.85	372.67	289.67	179.45	96.4	63.58	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	558.87	630.31	712.09	800.42	855.92	841.35	803.46	748.96	679.51	595.37	542.14	531.88	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.9	0.73	0.55	0.61	0.87	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.88	20.01	20.24	20.55	20.82	20.96	20.99	20.99	20.89	20.54	20.16	19.86	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.07	20.07	20.08	20.09	20.09	20.1	20.1	20.1	20.1	20.09	20.09	20.08	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.96	0.86	0.65	0.45	0.5	0.81	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.57	18.75	19.09	19.55	19.9	20.07	20.1	20.1	20	19.54	18.98	18.55	(90)

fLA = Living area ÷ (4) = | 0.3 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.96	19.13	19.44	19.85	20.18	20.34	20.37	20.36	20.27	19.84	19.34	18.94	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.96	19.13	19.44	19.85	20.18	20.34	20.37	20.36	20.27	19.84	19.34	18.94	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	1	1	0.99	0.96	0.86	0.67	0.48	0.54	0.82	0.97	1	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	557.7	627.53	703.22	765.42	739.03	565.46	384.83	401.68	559.26	579.93	539.72	531.04		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	1563.15	1512.75	1371.18	1144.65	883.82	591.09	387.95	407.41	638.27	963.59	1282.47	1553.69		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	748.06	594.87	496.96	273.04	107.72	0	0	0	0	285.44	534.78	760.85		
												Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	3801.73	(98)
Space heating requirement in kWh/m²/year													36.12	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	748.06	594.87	496.96	273.04	107.72	0	0	0	0	285.44	534.78	760.85		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	800.06	636.22	531.51	292.02	115.21	0	0	0	0	305.29	571.96	813.75		
												Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	4066.02	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
												Total (kWh/year) =Sum(215)$_{1...5,10....12}$=	0	(215)

Water heating

Output from water heater (calculated above)														
	210.21	185.18	194.26	173.83	170.12	151.68	145.37	159.94	159.79	180.26	191	205.04		
Efficiency of water heater													79.8	(216)
(217)m=	87.91	87.71	87.21	86.01	83.63	79.8	79.8	79.8	79.8	86.03	87.42	88		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	239.1	211.13	222.74	202.09	203.41	190.08	182.17	200.42	200.24	209.52	218.5	233.02		
												Total = Sum(219a)$_{1...12}$ =	2512.42	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		4066.02

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Water heating fuel used			2512.42	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			460.27	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	878.26	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	542.68	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1420.94	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	238.88	(268)
Total CO2, kg/year		sum of (265)…(271) =		1698.75	(272)
TER =				16.14	(273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-2-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	86.91	(1a)	x	2.4	(2a)	=	208.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.91	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			208.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 4			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 5			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Floor			86.91	x	0.11	=	9.560101			(28)
Walls Type1	47.44	17.25	30.19	x	0.18	=	5.43			(29)
Walls Type2	10.78	2.1	8.68	x	0.18	=	1.56			(29)
Total area of elements, m²			145.13							(31)
Party wall			48.43	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.83 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 17.58 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 56.41 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	90.82	90.82	90.82	90.82	90.82	90.82	90.82	90.82	90.82	90.82	90.82	90.82	

Average = Sum(39)$_{1…12}$ /12= 90.82 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	

Average = Sum(40)$_{1…12}$ /12= 1.05 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.58 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.5 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	105.05	101.23	97.41	93.59	89.77	85.95	85.95	89.77	93.59	97.41	101.23	105.05	

Total = Sum(44)$_{1…12}$ = 1145.99 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.78	136.25	140.6	122.58	117.62	101.49	94.05	107.92	109.21	127.27	138.93	150.87	

Total = Sum(45)$_{1…12}$ = 1502.57 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.37	20.44	21.09	18.39	17.64	15.22	14.11	16.19	16.38	19.09	20.84	22.63	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.06	186.18	195.88	176.07	172.89	154.99	149.33	163.2	162.7	182.55	192.42	206.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.06	186.18	195.88	176.07	172.89	154.99	149.33	163.2	162.7	182.55	192.42	206.15

Output from water heater (annual)$_{1…12}$ — 2153.41 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	96.02	85.25	90.97	83.55	83.33	76.54	75.49	80.11	79.11	86.54	88.99	94.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.79	18.47	15.02	11.37	8.5	7.18	7.75	10.08	13.53	17.18	20.05	21.37	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	233.28	235.7	229.6	216.61	200.22	184.81	174.52	172.1	178.2	191.18	207.58	222.98	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	(71)

Water heating gains (Table 5)

(72)m=	129.06	126.85	122.27	116.04	112	106.31	101.47	107.67	109.87	116.32	123.6	126.86	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	444.84	442.73	428.6	405.74	382.43	360.01	345.46	351.56	363.31	386.39	412.94	432.93	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)

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West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	80.71	157.17	260.4	387.27	484.5	501.1	474.91	400.76	304.85	186.61	100.42	66.55	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	525.55	599.91	689.01	793.01	866.93	861.11	820.37	752.32	668.16	573.01	513.36	499.48	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.83	0.65	0.48	0.54	0.82	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.91	20.05	20.3	20.62	20.87	20.97	21	20.99	20.91	20.57	20.17	19.87	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.78	0.56	0.38	0.44	0.74	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.58	18.79	19.15	19.6	19.92	20.03	20.04	20.04	19.98	19.55	18.97	18.53	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.11	19.29	19.61	20.01	20.3	20.41	20.42	20.42	20.35	19.96	19.45	19.06	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.11	19.29	19.61	20.01	20.3	20.41	20.42	20.42	20.35	19.96	19.45	19.06	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.8	0.6	0.42	0.48	0.77	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	523.6	595.15	673.67	734.67	691.06	512.48	345.49	361.54	513.37	549.18	509.34	498.05	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1345.4	1307.12	1190.67	1008.68	780.8	527.37	347.38	365.3	567.6	850.02	1121.86	1350.03	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	611.42	478.44	384.65	197.29	66.76	0	0	0	0	223.82	441.02	633.87	

	Total per year (kWh/year) = Sum(98)1...5,9...12 =	3037.27	(98)
Space heating requirement in kWh/m²/year		34.95	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		3037.27	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	2391.85	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	797.28	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2153.41	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1695.81	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	565.27	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	54.5	(313)

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Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		56.24	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	56.24	(331)
Energy for lighting (calculated in Appendix L)		367.2	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
Space heating from CHP)	(307a) × 100 ÷ (362) =	6294.35	x	0.22		1359.58	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	2014.19	x	0.52		-1045.37	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4462.67	x	0.22		963.94	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1428.05	x	0.52		-741.16	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	316.46	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	28.29	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	881.74	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					881.74	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	29.19	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	190.58	(379)

Total CO2, kg/year	sum of (376)…(382) =	1101.51	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =	12.67	(384)
EI rating (section 14)		88.81	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-2-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.91	(1a) x	2.4	(2a) =	208.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.91	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	208.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.39	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 4			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 5			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Floor			86.91	x	0.13	=	11.2983			(28)
Walls Type1	47.44	17.25	30.19	x	0.18	=	5.43			(29)
Walls Type2	10.78	2.1	8.68	x	0.18	=	1.56			(29)
Total area of elements, m²			145.13							(31)
Party wall			48.43	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	43.26	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		16.1	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	59.36	(37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.69	40.44	40.2	39.08	38.87	37.9	37.9	37.72	38.27	38.87	39.3	39.74	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	100.05	99.81	99.57	98.45	98.24	97.26	97.26	97.08	97.64	98.24	98.66	99.11	

Average = $Sum(39)_{1...12}$ /12= 98.45 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.15	1.15	1.15	1.13	1.13	1.12	1.12	1.12	1.12	1.13	1.14	1.14

Average = $Sum(40)_{1...12}$ /12= 1.13 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.58 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.5 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	105.05	101.23	97.41	93.59	89.77	85.95	85.95	89.77	93.59	97.41	101.23	105.05	

Total = $Sum(44)_{1...12}$ = 1145.99 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.78	136.25	140.6	122.58	117.62	101.49	94.05	107.92	109.21	127.27	138.93	150.87

Total = $Sum(45)_{1...12}$ = 1502.57 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.37	20.44	21.09	18.39	17.64	15.22	14.11	16.19	16.38	19.09	20.84	22.63	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.38	178.34	187.19	167.67	164.21	146.59	140.64	154.52	154.3	173.87	184.02	197.46	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.38	178.34	187.19	167.67	164.21	146.59	140.64	154.52	154.3	173.87	184.02	197.46

Output from water heater (annual)$_{1...12}$ | 2051.19 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.07	78.97	84.02	76.83	76.38	69.82	68.55	73.16	72.39	79.59	82.27	87.44	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.96	18.62	15.14	11.46	8.57	7.23	7.82	10.16	13.64	17.31	20.21	21.54	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	233.28	235.7	229.6	216.61	200.22	184.81	174.52	172.1	178.2	191.18	207.58	222.98	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	(71)

Water heating gains (Table 5)

(72)m=	119.72	117.52	112.94	106.71	102.67	96.97	92.13	98.33	100.54	106.98	114.26	117.53	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	438.68	436.55	422.39	399.5	376.17	353.73	339.18	345.31	357.09	380.2	406.76	426.77	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.29	x	10.63	x	0.63	x	0.7	=	17.19	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.63	x	0.7	=	32.85	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.63	x	0.7	=	55.82	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.63	x	0.7	=	89.67	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.63	x	0.7	=	120.79	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.63	x	0.7	=	129.31	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.63	x	0.7	=	120.73	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.63	x	0.7	=	95.78	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.63	x	0.7	=	67.12	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.63	x	0.7	=	39.11	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.63	x	0.7	=	21.21	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.63	x	0.7	=	14.33	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)

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West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	88.98	173.28	287.1	426.96	534.16	552.47	523.59	441.84	336.1	205.74	110.72	73.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	527.65	609.83	709.49	826.46	910.33	906.2	862.77	787.14	693.18	585.94	517.48	500.13	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.84	0.65	0.49	0.55	0.82	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.76	19.92	20.19	20.56	20.84	20.97	20.99	20.99	20.89	20.51	20.07	19.74	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.96	19.96	19.96	19.97	19.98	19.99	19.99	19.99	19.98	19.98	19.97	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.79	0.56	0.38	0.44	0.75	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.31	18.54	18.94	19.46	19.82	19.96	19.98	19.98	19.89	19.41	18.77	18.28	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.89	19.09	19.44	19.9	20.23	20.36	20.39	20.38	20.29	19.85	19.29	18.86	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(93)m=	18.89	19.09	19.44	19.9	20.23	20.36	20.39	20.38	20.29	19.85	19.29	18.86		(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	1	0.99	0.98	0.93	0.8	0.6	0.42	0.48	0.77	0.96	0.99	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	525.62	604.8	693.31	765.11	727.63	541.5	365.66	381.68	536.93	562.04	513.39	498.65		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	1460.04	1416.47	1288.74	1082.8	837.63	560.65	368.34	386.83	604.59	908.6	1202.94	1453.3		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	695.21	545.45	443	228.74	81.84	0	0	0	0	257.84	496.48	710.26		
Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =													3458.81	(98)

Space heating requirement in kWh/m²/year	39.8	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	695.21	545.45	443	228.74	81.84	0	0	0	0	257.84	496.48	710.26		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	743.54	583.36	473.79	244.64	87.53	0	0	0	0	275.76	530.99	759.64		
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													3699.26	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	202.38	178.34	187.19	167.67	164.21	146.59	140.64	154.52	154.3	173.87	184.02	197.46		
Efficiency of water heater													79.8	(216)
(217)m=	87.84	87.61	87.03	85.64	83.07	79.8	79.8	79.8	79.8	85.86	87.33	87.94		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	230.38	203.57	215.08	195.78	197.69	183.69	176.24	193.63	193.36	202.5	210.71	224.56		
Total = Sum(219a)$_{1...12}$ =													2427.19	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3699.26

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Water heating fuel used			2427.19	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			370.17	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	799.04	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	524.27	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1323.31	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	192.12	(268)
Total CO2, kg/year		sum of (265)…(271) =		1554.35	(272)

TER = 17.88 (273)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-3-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.14	(1a) x	2.4	(2a) =	206.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.14	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	206.74	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 4			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 5			8.05	x1/[1/(1.2)+ 0.04]		=	9.22			(27)
Walls Type1	44.62	19.78	24.84	x	0.18	=	4.47			(29)
Walls Type2	5.87	2.1	3.77	x	0.18	=	0.68			(29)
Total area of elements, m²			50.49							(31)
Party wall			44.11	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.84 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 41.16 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	75.27	75.27	75.27	75.27	75.27	75.27	75.27	75.27	75.27	75.27	75.27	75.27	

Average = $Sum(39)_{1...12}$ /12= 75.27 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	

Average = $Sum(40)_{1...12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	104.74	100.93	97.12	93.31	89.5	85.69	85.69	89.5	93.31	97.12	100.93	104.74	

Total = $Sum(44)_{1...12}$ = 1142.6 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.32	135.85	140.18	122.21	117.27	101.19	93.77	107.6	108.89	126.9	138.52	150.42	

Total = $Sum(45)_{1...12}$ = 1498.13 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.3	20.38	21.03	18.33	17.59	15.18	14.07	16.14	16.33	19.03	20.78	22.56	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.6	185.77	195.46	175.71	172.54	154.69	149.05	162.88	162.38	182.17	192.01	205.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	210.6	185.77	195.46	175.71	172.54	154.69	149.05	162.88	162.38	182.17	192.01	205.7

Output from water heater (annual)$_{1...12}$ | 2148.97 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	95.87	85.11	90.83	83.43	83.21	76.44	75.4	80	79	86.42	88.85	94.24	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.66	18.35	14.93	11.3	8.45	7.13	7.71	10.02	13.44	17.07	19.92	21.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	231.79	234.2	228.14	215.23	198.95	183.64	173.41	171	177.07	189.97	206.26	221.57	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	(71)

Water heating gains (Table 5)

(72)m=	128.85	126.65	122.09	115.88	111.85	106.17	101.34	107.53	109.72	116.15	123.41	126.66	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	442.85	440.74	426.69	403.95	380.78	358.47	344	350.08	361.77	384.73	411.12	431.01	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)

North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42 (74)
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59 (74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55 (74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36 (74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36 (74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8 (74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42 (74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61 (74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61 (74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63 (74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43 (74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29 (74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29 (74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33 (74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16 (74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11 (74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11 (74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56 (74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19 (74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8 (74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8 (74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29 (74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13 (74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09 (74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09 (74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5 (74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33 (74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22 (74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22 (74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88 (74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76 (74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18 (74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18 (74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88 (74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51 (74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34 (74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34 (74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47 (74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04 (74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69 (74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69 (74)

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North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
East	0.9x	1	x	8.05	x	19.64	x	0.5	x	0.8	=	43.83	(76)
East	0.9x	1	x	8.05	x	38.42	x	0.5	x	0.8	=	85.73	(76)
East	0.9x	1	x	8.05	x	63.27	x	0.5	x	0.8	=	141.19	(76)
East	0.9x	1	x	8.05	x	92.28	x	0.5	x	0.8	=	205.92	(76)
East	0.9x	1	x	8.05	x	113.09	x	0.5	x	0.8	=	252.36	(76)
East	0.9x	1	x	8.05	x	115.77	x	0.5	x	0.8	=	258.34	(76)
East	0.9x	1	x	8.05	x	110.22	x	0.5	x	0.8	=	245.95	(76)
East	0.9x	1	x	8.05	x	94.68	x	0.5	x	0.8	=	211.27	(76)
East	0.9x	1	x	8.05	x	73.59	x	0.5	x	0.8	=	164.21	(76)
East	0.9x	1	x	8.05	x	45.59	x	0.5	x	0.8	=	101.73	(76)
East	0.9x	1	x	8.05	x	24.49	x	0.5	x	0.8	=	54.65	(76)
East	0.9x	1	x	8.05	x	16.15	x	0.5	x	0.8	=	36.04	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	78.4	151.81	253.47	386.27	495.3	518.41	488.76	403.91	299.2	180.38	97.3	64.86	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.25	592.55	680.16	790.21	876.08	876.89	832.76	753.99	660.97	565.11	508.42	495.87	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.75	0.54	0.4	0.46	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.29	20.51	20.79	20.95	20.99	21	21	20.97	20.72	20.38	20.12	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.89	0.7	0.48	0.32	0.38	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.24	19.57	19.95	20.15	20.19	20.19	20.19	20.16	19.87	19.38	19	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.66	19.95	20.28	20.47	20.51	20.51	20.51	20.49	20.21	19.78	19.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.66	19.95	20.28	20.47	20.51	20.51	20.51	20.49	20.21	19.78	19.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.72	0.5	0.35	0.41	0.7	0.94	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	519.23	587.22	660.85	707.46	628.68	441.76	294.31	308.92	461.1	533.89	503.88	494.44	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1143.66	1111.07	1012.26	856.78	660	444.83	294.59	309.6	480.64	723.67	954.53	1147.6	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	464.57	352.03	261.45	107.51	23.3	0	0	0	0	141.2	324.47	485.95

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2160.47 (98)

Space heating requirement in kWh/m²/year 25.08 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2160.47	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1701.37	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	567.12	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2148.97	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1692.31	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	564.1	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	45.25	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		55.74	(330a)

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warm air heating system fans						0	(330b)
pump for solar water heating						0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =					55.74	(331)
Energy for lighting (calculated in Appendix L)						364.94	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4477.28	x	0.22		967.09	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1432.73	x	0.52		-743.59	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4453.45	x	0.22		961.95	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1425.1	x	0.52		-739.63	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	262.74	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	23.48	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	732.04	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					732.04	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	28.93	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	189.41	(379)
Total CO2, kg/year	sum of (376)…(382) =					950.38	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					11.03	(384)
EI rating (section 14)						90.29	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-3-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.14	(1a) x	2.4	(2a) =	206.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.14	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	206.74	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.71	x1/[1/(1.4)+ 0.04]		=	3.59			(27)
Windows Type 2			1.81	x1/[1/(1.4)+ 0.04]		=	2.4			(27)
Windows Type 3			1.81	x1/[1/(1.4)+ 0.04]		=	2.4			(27)
Windows Type 4			5.2	x1/[1/(1.4)+ 0.04]		=	6.89			(27)
Windows Type 5			7.91	x1/[1/(1.4)+ 0.04]		=	10.49			(27)
Walls Type1	44.62	19.44	25.18	x	0.18	=	4.53			(29)
Walls Type2	5.87	2.1	3.77	x	0.18	=	0.68			(29)
Total area of elements, m²			50.49							(31)
Party wall			44.11	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.08 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.76 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 37.85 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	40.37	40.12	39.89	38.77	38.56	37.58	37.58	37.4	37.96	38.56	38.98	39.42		(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.21	77.97	77.73	76.62	76.41	75.43	75.43	75.25	75.81	76.41	76.83	77.27		

Average = Sum(39)$_{1…12}$ /12= 76.61 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.91	0.91	0.9	0.89	0.89	0.88	0.88	0.87	0.88	0.89	0.89	0.9

Average = Sum(40)$_{1…12}$ /12= 0.89 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	104.74	100.93	97.12	93.31	89.5	85.69	85.69	89.5	93.31	97.12	100.93	104.74

Total = Sum(44)$_{1…12}$ = 1142.6 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.32	135.85	140.18	122.21	117.27	101.19	93.77	107.6	108.89	126.9	138.52	150.42

Total = Sum(45)$_{1…12}$ = 1498.13 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.3	20.38	21.03	18.33	17.59	15.18	14.07	16.14	16.33	19.03	20.78	22.56	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.92	177.93	186.78	167.31	163.86	146.28	140.36	154.2	153.98	173.49	183.61	197.02	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.92	177.93	186.78	167.31	163.86	146.28	140.36	154.2	153.98	173.49	183.61	197.02

Output from water heater (annual)$_{1...12}$ | 2046.74 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	88.92	78.84	83.89	76.71	76.27	69.72	68.45	73.05	72.28	79.47	82.13	87.29	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.66	18.35	14.92	11.3	8.45	7.13	7.7	10.01	13.44	17.07	19.92	21.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	231.79	234.2	228.14	215.23	198.95	183.64	173.41	171	177.07	189.97	206.26	221.57	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	(71)

Water heating gains (Table 5)

(72)m=	119.52	117.32	112.75	106.54	102.51	96.83	92.01	98.19	100.39	106.81	114.07	117.33	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	436.51	434.41	420.35	397.61	374.44	352.14	337.66	343.75	355.43	378.39	404.79	424.67	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.71	x	10.63	x	0.63	x	0.7	=	8.81	(74)
North	0.9x	0.77	x	1.81	x	10.63	x	0.63	x	0.7	=	5.88	(74)

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North	0.9x	0.77	x	1.81	x	10.63	x	0.63	x	0.7	=	5.88	(74)
North	0.9x	0.77	x	5.2	x	10.63	x	0.63	x	0.7	=	16.9	(74)
North	0.9x	0.77	x	2.71	x	20.32	x	0.63	x	0.7	=	16.83	(74)
North	0.9x	0.77	x	1.81	x	20.32	x	0.63	x	0.7	=	11.24	(74)
North	0.9x	0.77	x	1.81	x	20.32	x	0.63	x	0.7	=	11.24	(74)
North	0.9x	0.77	x	5.2	x	20.32	x	0.63	x	0.7	=	32.29	(74)
North	0.9x	0.77	x	2.71	x	34.53	x	0.63	x	0.7	=	28.6	(74)
North	0.9x	0.77	x	1.81	x	34.53	x	0.63	x	0.7	=	19.1	(74)
North	0.9x	0.77	x	1.81	x	34.53	x	0.63	x	0.7	=	19.1	(74)
North	0.9x	0.77	x	5.2	x	34.53	x	0.63	x	0.7	=	54.88	(74)
North	0.9x	0.77	x	2.71	x	55.46	x	0.63	x	0.7	=	45.94	(74)
North	0.9x	0.77	x	1.81	x	55.46	x	0.63	x	0.7	=	30.68	(74)
North	0.9x	0.77	x	1.81	x	55.46	x	0.63	x	0.7	=	30.68	(74)
North	0.9x	0.77	x	5.2	x	55.46	x	0.63	x	0.7	=	88.14	(74)
North	0.9x	0.77	x	2.71	x	74.72	x	0.63	x	0.7	=	61.88	(74)
North	0.9x	0.77	x	1.81	x	74.72	x	0.63	x	0.7	=	41.33	(74)
North	0.9x	0.77	x	1.81	x	74.72	x	0.63	x	0.7	=	41.33	(74)
North	0.9x	0.77	x	5.2	x	74.72	x	0.63	x	0.7	=	118.74	(74)
North	0.9x	0.77	x	2.71	x	79.99	x	0.63	x	0.7	=	66.24	(74)
North	0.9x	0.77	x	1.81	x	79.99	x	0.63	x	0.7	=	44.24	(74)
North	0.9x	0.77	x	1.81	x	79.99	x	0.63	x	0.7	=	44.24	(74)
North	0.9x	0.77	x	5.2	x	79.99	x	0.63	x	0.7	=	127.11	(74)
North	0.9x	0.77	x	2.71	x	74.68	x	0.63	x	0.7	=	61.85	(74)
North	0.9x	0.77	x	1.81	x	74.68	x	0.63	x	0.7	=	41.31	(74)
North	0.9x	0.77	x	1.81	x	74.68	x	0.63	x	0.7	=	41.31	(74)
North	0.9x	0.77	x	5.2	x	74.68	x	0.63	x	0.7	=	118.68	(74)
North	0.9x	0.77	x	2.71	x	59.25	x	0.63	x	0.7	=	49.07	(74)
North	0.9x	0.77	x	1.81	x	59.25	x	0.63	x	0.7	=	32.77	(74)
North	0.9x	0.77	x	1.81	x	59.25	x	0.63	x	0.7	=	32.77	(74)
North	0.9x	0.77	x	5.2	x	59.25	x	0.63	x	0.7	=	94.15	(74)
North	0.9x	0.77	x	2.71	x	41.52	x	0.63	x	0.7	=	34.38	(74)
North	0.9x	0.77	x	1.81	x	41.52	x	0.63	x	0.7	=	22.97	(74)
North	0.9x	0.77	x	1.81	x	41.52	x	0.63	x	0.7	=	22.97	(74)
North	0.9x	0.77	x	5.2	x	41.52	x	0.63	x	0.7	=	65.98	(74)
North	0.9x	0.77	x	2.71	x	24.19	x	0.63	x	0.7	=	20.03	(74)
North	0.9x	0.77	x	1.81	x	24.19	x	0.63	x	0.7	=	13.38	(74)
North	0.9x	0.77	x	1.81	x	24.19	x	0.63	x	0.7	=	13.38	(74)
North	0.9x	0.77	x	5.2	x	24.19	x	0.63	x	0.7	=	38.44	(74)
North	0.9x	0.77	x	2.71	x	13.12	x	0.63	x	0.7	=	10.86	(74)
North	0.9x	0.77	x	1.81	x	13.12	x	0.63	x	0.7	=	7.26	(74)
North	0.9x	0.77	x	1.81	x	13.12	x	0.63	x	0.7	=	7.26	(74)

North	0.9x	0.77	x	5.2	x	13.12	x	0.63	x	0.7	=	20.85	(74)
North	0.9x	0.77	x	2.71	x	8.86	x	0.63	x	0.7	=	7.34	(74)
North	0.9x	0.77	x	1.81	x	8.86	x	0.63	x	0.7	=	4.9	(74)
North	0.9x	0.77	x	1.81	x	8.86	x	0.63	x	0.7	=	4.9	(74)
North	0.9x	0.77	x	5.2	x	8.86	x	0.63	x	0.7	=	14.09	(74)
East	0.9x	1	x	7.91	x	19.64	x	0.63	x	0.7	=	47.48	(76)
East	0.9x	1	x	7.91	x	38.42	x	0.63	x	0.7	=	92.88	(76)
East	0.9x	1	x	7.91	x	63.27	x	0.63	x	0.7	=	152.96	(76)
East	0.9x	1	x	7.91	x	92.28	x	0.63	x	0.7	=	223.08	(76)
East	0.9x	1	x	7.91	x	113.09	x	0.63	x	0.7	=	273.39	(76)
East	0.9x	1	x	7.91	x	115.77	x	0.63	x	0.7	=	279.86	(76)
East	0.9x	1	x	7.91	x	110.22	x	0.63	x	0.7	=	266.44	(76)
East	0.9x	1	x	7.91	x	94.68	x	0.63	x	0.7	=	228.87	(76)
East	0.9x	1	x	7.91	x	73.59	x	0.63	x	0.7	=	177.89	(76)
East	0.9x	1	x	7.91	x	45.59	x	0.63	x	0.7	=	110.21	(76)
East	0.9x	1	x	7.91	x	24.49	x	0.63	x	0.7	=	59.2	(76)
East	0.9x	1	x	7.91	x	16.15	x	0.63	x	0.7	=	39.04	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	84.95	164.48	274.63	418.52	536.67	561.71	529.58	437.64	324.19	195.44	105.42	70.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.46	598.89	694.98	816.13	911.11	913.85	867.24	781.38	679.62	573.83	510.21	494.95	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.74	0.52	0.38	0.44	0.73	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.1	20.25	20.49	20.79	20.95	21	21	21	20.97	20.72	20.36	20.08	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.16	20.17	20.18	20.18	20.19	20.19	20.19	20.18	20.18	20.17	20.17	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.46	0.31	0.36	0.66	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.96	19.17	19.52	19.94	20.14	20.19	20.19	20.19	20.16	19.86	19.34	18.93	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.42	19.6	19.91	20.28	20.46	20.51	20.51	20.51	20.48	20.2	19.75	19.39	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.42	19.6	19.91	20.28	20.46	20.51	20.51	20.51	20.48	20.2	19.75	19.39	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.89	0.7	0.49	0.34	0.4	0.69	0.94	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	519.47	593.43	674.54	724.67	640.32	443.23	294.92	308.98	465.79	541.19	505.67	493.54	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1182.27	1146.13	1042.26	871.77	669.64	445.75	295.14	309.53	483.96	733.74	971.69	1173.85	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	493.12	371.41	273.59	105.91	21.82	0	0	0	0	143.26	335.53	506.14

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2250.79 (98)

Space heating requirement in kWh/m²/year 26.13 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	493.12	371.41	273.59	105.91	21.82	0	0	0	0	143.26	335.53	506.14	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	527.4	397.23	292.61	113.28	23.33	0	0	0	0	153.22	358.86	541.33	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2407.27 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

201.92	177.93	186.78	167.31	163.86	146.28	140.36	154.2	153.98	173.49	183.61	197.02

Efficiency of water heater 79.8 (216)

(217)m=	87.11	86.73	85.83	83.63	80.92	79.8	79.8	79.8	79.8	84.31	86.4	87.22	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	231.81	205.15	217.61	200.05	202.49	183.31	175.9	193.23	192.96	205.78	212.51	225.88

Total = Sum(219a)$_{1...12}$ = 2446.67 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2407.27
Water heating fuel used		2446.67
Electricity for pumps, fans and electric keep-hot		

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central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			364.88	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	519.97	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	528.48	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1048.45	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.37	(268)
Total CO2, kg/year		sum of (265)…(271) =		1276.75	(272)

TER = 14.82 (273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-3-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.42	(1a) x	2.4	(2a) =	171.41	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.42	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.41	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Walls Type1	28.74	10.12	18.62	x	0.18	=	3.35			(29)
Walls Type2	43.06	2.1	40.96	x	0.18	=	7.37			(29)
Total area of elements, m²			71.8							(31)
Party wall			14.79	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 24.83 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.38 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 35.21 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	63.49	63.49	63.49	63.49	63.49	63.49	63.49	63.49	63.49	63.49	63.49	63.49

Average = Sum(39)$_{1…12}$ /12= 63.49 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(40)m=	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89

Average = Sum(40)$_{1...12}$ /12= 0.89 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.28 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	97.19	93.65	90.12	86.59	83.05	79.52	79.52	83.05	86.59	90.12	93.65	97.19	

Total = Sum(44)$_{1...12}$ = 1060.23 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	144.13	126.05	130.08	113.4	108.81	93.9	87.01	99.85	101.04	117.75	128.53	139.58	

Total = Sum(45)$_{1...12}$ = 1390.13 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	21.62	18.91	19.51	17.01	16.32	14.08	13.05	14.98	15.16	17.66	19.28	20.94	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.4	175.98	185.35	166.9	164.09	147.39	142.29	155.12	154.53	173.03	182.03	194.86	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.4	175.98	185.35	166.9	164.09	147.39	142.29	155.12	154.53	173.03	182.03	194.86

Output from water heater (annual)$_{1...12}$ 2040.97 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.14	81.85	87.47	80.5	80.4	74.02	73.15	77.42	76.39	83.37	85.53	90.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114	114	114	114	114	114	114	114	114	114	114	114	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.61	16.53	13.44	10.18	7.61	6.42	6.94	9.02	12.11	15.37	17.94	19.13	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.59	202.67	197.42	186.26	172.16	158.91	150.06	147.98	153.23	164.39	178.49	191.74	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	(71)

Water heating gains (Table 5)

(72)m=	123.85	121.81	117.57	111.81	108.07	102.8	98.32	104.06	106.1	112.06	118.79	121.82	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	400.25	398.21	385.64	365.45	345.04	325.34	312.53	318.26	328.64	349.03	372.43	389.89	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)

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East	0.9x	1	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	55.1	107.78	177.5	258.87	317.25	324.77	309.19	265.59	206.44	127.89	68.7	45.31	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	455.35	505.99	563.14	624.32	662.29	650.11	621.72	583.86	535.07	476.92	441.13	435.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.81	0.61	0.45	0.5	0.76	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.28	20.49	20.74	20.92	20.99	21	21	20.96	20.72	20.39	20.13	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.91	0.76	0.54	0.36	0.41	0.69	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.06	19.23	19.53	19.88	20.1	20.17	20.18	20.18	20.15	19.86	19.38	19	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.5	19.65	19.92	20.23	20.43	20.5	20.51	20.5	20.47	20.2	19.78	19.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.5	19.65	19.92	20.23	20.43	20.5	20.51	20.5	20.47	20.2	19.78	19.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.77	0.57	0.4	0.44	0.72	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	453.07	500.84	547.73	570.77	512.96	369.15	247.46	259.64	384.44	449.66	436.31	433.52	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	965.02	936.61	851.8	719.16	554.42	374.42	247.96	260.6	404.5	609.65	805.33	968.45	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	380.89	292.84	226.23	106.84	30.85	0	0	0	0	119.03	265.7	397.99	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1820.37 (98)

Space heating requirement in kWh/m²/year 25.49 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating	**kWh/year**
Annual space heating requirement	1820.37

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Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1433.54	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	477.85	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2040.97	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1607.26	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	535.75	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	40.54	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.22	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	46.22	(331)
Energy for lighting (calculated in Appendix L)		328.7	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	3772.47	x	0.22		814.85	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1207.19	x	0.52		-626.53	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4229.63	x	0.22		913.6	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1353.48	x	0.52		-702.46	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	235.42	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	21.04	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	655.92	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					655.92	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	23.99	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	170.6	(379)
Total CO2, kg/year	sum of (376)…(382) =					850.51	(383)

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Dwelling CO2 Emission Rate	(383) ÷ (4) =	11.91	(384)
EI rating (section 14)		90.21	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-3-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.42	(1a) x	2.4	(2a) =	171.41	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.42	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.41	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.43	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Walls Type1	28.74	10.12	18.62	x	0.18	=	3.35			(29)
Walls Type2	43.06	2.1	40.96	x	0.18	=	7.37			(29)
Total area of elements, m²			71.8							(31)
Party wall			14.79	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 26.24 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.21 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 32.45 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.28	34.05	33.82	32.75	32.55	31.61	31.61	31.44	31.97	32.55	32.95	33.38	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	66.73	66.5	66.27	65.2	65	64.06	64.06	63.89	64.42	65	65.41	65.83	

Average = Sum(39)$_{1…12}$ /12= 65.2 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.91	0.91	0.9	0.9	0.89	0.9	0.91	0.92	0.92

Average = Sum(40)1…12 /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.28 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	97.19	93.65	90.12	86.59	83.05	79.52	79.52	83.05	86.59	90.12	93.65	97.19	
										Total = Sum(44)1…12 =		1060.23	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	144.13	126.05	130.08	113.4	108.81	93.9	87.01	99.85	101.04	117.75	128.53	139.58	
										Total = Sum(45)1…12 =		1390.13	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	21.62	18.91	19.51	17.01	16.32	14.08	13.05	14.98	15.16	17.66	19.28	20.94	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	190.72	168.14	176.67	158.5	155.41	138.99	133.61	146.44	146.13	164.34	173.63	186.17	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	190.72	168.14	176.67	158.5	155.41	138.99	133.61	146.44	146.13	164.34	173.63	186.17	

Output from water heater (annual)$_{1\ldots12}$ 1938.74 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.2	75.58	80.53	73.78	73.46	67.29	66.21	70.47	69.67	76.43	78.81	83.69	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114	114	114	114	114	114	114	114	114	114	114	114	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.13	17	13.82	10.46	7.82	6.6	7.14	9.27	12.45	15.81	18.45	19.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.59	202.67	197.42	186.26	172.16	158.91	150.06	147.98	153.23	164.39	178.49	191.74	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	(71)

Water heating gains (Table 5)

(72)m=	114.51	112.47	108.23	102.47	98.73	93.46	88.99	94.72	96.76	102.73	109.46	112.48	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	394.44	392.34	379.68	359.4	338.92	319.18	306.39	312.18	322.64	343.13	366.6	384.09	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)

East	0.9x	1	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	60.74	118.83	195.69	285.4	349.77	358.06	340.88	292.81	227.6	141	75.74	49.95	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	455.18	511.17	575.37	644.8	688.69	677.24	647.27	605	550.24	484.13	442.34	434.04	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.8	0.59	0.43	0.48	0.75	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.1	20.23	20.46	20.74	20.92	20.99	21	21	20.96	20.71	20.35	20.08	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.16	20.16	20.17	20.17	20.17	20.17	20.16	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.75	0.52	0.35	0.4	0.68	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.93	19.12	19.45	19.86	20.09	20.16	20.17	20.17	20.14	19.83	19.32	18.91	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.57	19.86	20.21	20.42	20.49	20.5	20.5	20.46	20.18	19.73	19.38	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.57	19.86	20.21	20.42	20.49	20.5	20.5	20.46	20.18	19.73	19.38	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.91	0.76	0.55	0.39	0.43	0.71	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	452.97	505.98	559.32	586.3	525.94	372.95	249.49	261.22	390.43	456.14	437.61	432.41	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1007.38	975.34	885.09	737.42	566.94	377.59	249.93	262.07	410.05	622.63	826.26	999.04	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	412.48	315.42	242.38	108.8	30.5	0	0	0	0	123.87	279.83	421.57	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1934.85 (98)

Space heating requirement in kWh/m²/year 27.09 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	412.48	315.42	242.38	108.8	30.5	0	0	0	0	123.87	279.83	421.57	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	441.16	337.34	259.23	116.37	32.62	0	0	0	0	132.48	299.28	450.88	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2069.36 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

190.72	168.14	176.67	158.5	155.41	138.99	133.61	146.44	146.13	164.34	173.63	186.17

Efficiency of water heater 79.8 (216)

(217)m=	86.82	86.47	85.66	83.83	81.38	79.8	79.8	79.8	79.8	84.07	86.08	86.93	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	219.68	194.45	206.25	189.06	190.97	174.17	167.42	183.51	183.12	195.48	201.7	214.17

Total = Sum(219a)$_{1...12}$ = 2319.98 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2069.36	
Water heating fuel used			2319.98	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			337.92	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	446.98	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	501.12	(264)
Space and water heating	(261) + (262) + (263) + (264) =				948.1	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	175.38	(268)
Total CO2, kg/year			sum of (265)…(271) =		1162.41	(272)

TER = 16.28 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-3-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.01	(1a) x	2.4	(2a) =	127.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.01	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	127.22	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	37.55	11.96	25.59	x	0.18	=	4.61			(29)
Walls Type2	25.99	2.1	23.89	x	0.18	=	4.3			(29)
Total area of elements, m²			63.54							(31)
Party wall			14.75	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.12 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.89 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 35.01 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	56	56	56	56	56	56	56	56	56	56	56	56	

Average = Sum(39)$_{1…12}$ /12= 56 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06

Average = Sum(40)$_{1…12}$ /12= 1.06 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.78 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 76.45 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	84.09	81.03	77.98	74.92	71.86	68.8	68.8	71.86	74.92	77.98	81.03	84.09	
(45)m=	124.71	109.07	112.55	98.12	94.15	81.25	75.29	86.39	87.42	101.88	111.21	120.77	
(46)m=	18.71	16.36	16.88	14.72	14.12	12.19	11.29	12.96	13.11	15.28	16.68	18.12	(46)

Total = Sum(44)$_{1…12}$ = 917.37 (44)

Total = Sum(45)$_{1…12}$ = 1202.82 (45)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.98	159	167.83	151.62	149.43	134.74	130.56	141.67	140.92	157.16	164.71	176.05	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.98	159	167.83	151.62	149.43	134.74	130.56	141.67	140.92	157.16	164.71	176.05

Output from water heater (annual)$_{1...12}$ | 1853.66 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.69	76.21	81.64	75.42	75.53	69.81	69.25	72.95	71.86	78.1	79.77	84.38	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.82	12.28	9.98	7.56	5.65	4.77	5.15	6.7	8.99	11.42	13.33	14.21	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	155.04	156.65	152.6	143.97	133.07	122.83	115.99	114.38	118.44	127.07	137.96	148.2	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	(71)

Water heating gains (Table 5)

(72)m=	115.17	113.4	109.74	104.75	101.51	96.96	93.08	98.05	99.81	104.97	110.8	113.41	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	333.72	332.02	322	305.96	289.92	274.24	263.91	268.81	276.92	293.14	311.77	325.5	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)

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East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)

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South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	113.51	195.48	270.93	337.99	378.11	374.49	361.47	332.12	294.49	217.19	136.4	96.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	447.23	527.49	592.93	643.95	668.03	648.73	625.38	600.93	571.41	510.33	448.17	422.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.86	0.72	0.54	0.39	0.43	0.65	0.89	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.3	20.54	20.78	20.93	20.99	21	21	20.97	20.77	20.39	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.83	0.66	0.47	0.31	0.34	0.57	0.86	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.88	19.15	19.49	19.8	19.98	20.03	20.04	20.04	20.02	19.8	19.27	18.8	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.73	20.01	20.29	20.45	20.51	20.52	20.52	20.49	20.28	19.83	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.73	20.01	20.29	20.45	20.51	20.52	20.52	20.49	20.28	19.83	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.97	0.93	0.84	0.69	0.5	0.35	0.38	0.61	0.87	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	440.47	509.77	549.21	540.49	461.62	326.52	218.87	229.72	346.67	442.87	433.74	417.43	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	850.93	830.3	756.89	637.94	490.28	330.91	219.38	230.54	358.04	542.38	712.89	852.93	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	305.39	215.4	154.52	70.17	21.32	0	0	0	0	74.03	200.99	324.01	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1365.84 (98)

Space heating requirement in kWh/m²/year 25.77 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1365.84	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1075.6	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	358.53	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1853.66	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1459.76	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	486.59	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	33.8	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		34.3	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	34.3	(331)
Energy for lighting (calculated in Appendix L)		244.11	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	2830.52	x	0.22	611.39	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	905.77	x	0.52	-470.09	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	3841.47	x	0.22	829.76	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1229.27	x	0.52	-637.99	(366)

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Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	196.29	(368)
Electrical energy for heat distribution	[(313) x	0.52	=	17.54	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	546.9	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			546.9	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	17.8	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	126.69	(379)
Total CO2, kg/year	sum of (376)…(382) =			691.39	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			13.04	(384)
EI rating (section 14)				90.55	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-3-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.01	(1a) x	2.4	(2a) =	127.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		127.22	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.29	x1/[1/(1.4)+ 0.04]		=	5.69			(27)
Windows Type 2			2.57	x1/[1/(1.4)+ 0.04]		=	3.41			(27)
Windows Type 3			2.57	x1/[1/(1.4)+ 0.04]		=	3.41			(27)
Windows Type 4			1.72	x1/[1/(1.4)+ 0.04]		=	2.28			(27)
Walls Type1	37.55	11.15	26.4	x	0.18	=	4.75			(29)
Walls Type2	25.99	2.1	23.89	x	0.18	=	4.3			(29)
Total area of elements, m²			63.54							(31)
Party wall			14.75	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.93 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.08 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 32.02 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.08	24.92	24.77	24.03	23.9	23.26	23.26	23.14	23.51	23.9	24.17	24.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	57.1	56.94	56.78	56.05	55.91	55.28	55.28	55.16	55.52	55.91	56.19	56.48

Average = Sum(39)$_{1…12}$ /12= 56.05 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(40)m=	1.08	1.07	1.07	1.06	1.05	1.04	1.04	1.04	1.05	1.05	1.06	1.07		

Average = Sum(40)$_{1...12}$ /12= 1.06 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.78 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 76.45 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	84.09	81.03	77.98	74.92	71.86	68.8	68.8	71.86	74.92	77.98	81.03	84.09	
											Total = Sum(44)$_{1...12}$ =	917.37	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	124.71	109.07	112.55	98.12	94.15	81.25	75.29	86.39	87.42	101.88	111.21	120.77	
											Total = Sum(45)$_{1...12}$ =	1202.82	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.71	16.36	16.88	14.72	14.12	12.19	11.29	12.96	13.11	15.28	16.68	18.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)
If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H													
(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	171.3	151.16	159.14	143.22	140.75	126.34	121.88	132.99	132.52	148.48	156.31	167.37	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	171.3	151.16	159.14	143.22	140.75	126.34	121.88	132.99	132.52	148.48	156.31	167.37	

Output from water heater (annual)$_{1...12}$ 1751.44 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	78.74	69.93	74.7	68.7	68.58	63.09	62.31	66	65.14	71.15	73.05	77.43	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	13.86	12.31	10.01	7.58	5.67	4.78	5.17	6.72	9.02	11.45	13.36	14.24	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	155.04	156.65	152.6	143.97	133.07	122.83	115.99	114.38	118.44	127.07	137.96	148.2	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	(71)
Water heating gains (Table 5)													
(72)m=	105.83	104.07	100.4	95.42	92.18	87.62	83.75	88.71	90.47	95.64	101.46	104.08	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	327.42	325.71	315.69	299.64	283.6	267.92	257.59	262.49	270.61	286.83	305.47	319.21	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.57	x	19.64	x	0.63	x	0.7	=	15.43	(76)
East	0.9x	1	x	2.57	x	19.64	x	0.63	x	0.7	=	15.43	(76)
East	0.9x	1	x	2.57	x	38.42	x	0.63	x	0.7	=	30.18	(76)
East	0.9x	1	x	2.57	x	38.42	x	0.63	x	0.7	=	30.18	(76)
East	0.9x	1	x	2.57	x	63.27	x	0.63	x	0.7	=	49.7	(76)

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East	0.9x	1	x	2.57	x	63.27	x	0.63	x	0.7	=	49.7	(76)
East	0.9x	1	x	2.57	x	92.28	x	0.63	x	0.7	=	72.48	(76)
East	0.9x	1	x	2.57	x	92.28	x	0.63	x	0.7	=	72.48	(76)
East	0.9x	1	x	2.57	x	113.09	x	0.63	x	0.7	=	88.83	(76)
East	0.9x	1	x	2.57	x	113.09	x	0.63	x	0.7	=	88.83	(76)
East	0.9x	1	x	2.57	x	115.77	x	0.63	x	0.7	=	90.93	(76)
East	0.9x	1	x	2.57	x	115.77	x	0.63	x	0.7	=	90.93	(76)
East	0.9x	1	x	2.57	x	110.22	x	0.63	x	0.7	=	86.57	(76)
East	0.9x	1	x	2.57	x	110.22	x	0.63	x	0.7	=	86.57	(76)
East	0.9x	1	x	2.57	x	94.68	x	0.63	x	0.7	=	74.36	(76)
East	0.9x	1	x	2.57	x	94.68	x	0.63	x	0.7	=	74.36	(76)
East	0.9x	1	x	2.57	x	73.59	x	0.63	x	0.7	=	57.8	(76)
East	0.9x	1	x	2.57	x	73.59	x	0.63	x	0.7	=	57.8	(76)
East	0.9x	1	x	2.57	x	45.59	x	0.63	x	0.7	=	35.81	(76)
East	0.9x	1	x	2.57	x	45.59	x	0.63	x	0.7	=	35.81	(76)
East	0.9x	1	x	2.57	x	24.49	x	0.63	x	0.7	=	19.23	(76)
East	0.9x	1	x	2.57	x	24.49	x	0.63	x	0.7	=	19.23	(76)
East	0.9x	1	x	2.57	x	16.15	x	0.63	x	0.7	=	12.69	(76)
East	0.9x	1	x	2.57	x	16.15	x	0.63	x	0.7	=	12.69	(76)
South	0.9x	0.77	x	4.29	x	46.75	x	0.63	x	0.7	=	61.3	(78)
South	0.9x	0.77	x	1.72	x	46.75	x	0.63	x	0.7	=	24.58	(78)
South	0.9x	0.77	x	4.29	x	76.57	x	0.63	x	0.7	=	100.39	(78)
South	0.9x	0.77	x	1.72	x	76.57	x	0.63	x	0.7	=	40.25	(78)
South	0.9x	0.77	x	4.29	x	97.53	x	0.63	x	0.7	=	127.87	(78)
South	0.9x	0.77	x	1.72	x	97.53	x	0.63	x	0.7	=	51.27	(78)
South	0.9x	0.77	x	4.29	x	110.23	x	0.63	x	0.7	=	144.53	(78)
South	0.9x	0.77	x	1.72	x	110.23	x	0.63	x	0.7	=	57.95	(78)
South	0.9x	0.77	x	4.29	x	114.87	x	0.63	x	0.7	=	150.61	(78)
South	0.9x	0.77	x	1.72	x	114.87	x	0.63	x	0.7	=	60.38	(78)
South	0.9x	0.77	x	4.29	x	110.55	x	0.63	x	0.7	=	144.94	(78)
South	0.9x	0.77	x	1.72	x	110.55	x	0.63	x	0.7	=	58.11	(78)
South	0.9x	0.77	x	4.29	x	108.01	x	0.63	x	0.7	=	141.61	(78)
South	0.9x	0.77	x	1.72	x	108.01	x	0.63	x	0.7	=	56.78	(78)
South	0.9x	0.77	x	4.29	x	104.89	x	0.63	x	0.7	=	137.53	(78)
South	0.9x	0.77	x	1.72	x	104.89	x	0.63	x	0.7	=	55.14	(78)
South	0.9x	0.77	x	4.29	x	101.89	x	0.63	x	0.7	=	133.58	(78)
South	0.9x	0.77	x	1.72	x	101.89	x	0.63	x	0.7	=	53.56	(78)
South	0.9x	0.77	x	4.29	x	82.59	x	0.63	x	0.7	=	108.28	(78)
South	0.9x	0.77	x	1.72	x	82.59	x	0.63	x	0.7	=	43.41	(78)
South	0.9x	0.77	x	4.29	x	55.42	x	0.63	x	0.7	=	72.66	(78)
South	0.9x	0.77	x	1.72	x	55.42	x	0.63	x	0.7	=	29.13	(78)

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South	0.9x	0.77	x	4.29	x	40.4	x	0.63	x	0.7	=	52.97	(78)
South	0.9x	0.77	x	1.72	x	40.4	x	0.63	x	0.7	=	21.24	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	116.72	200.99	278.54	347.43	388.64	384.91	371.53	341.39	302.73	223.3	140.26	99.57	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	444.14	526.7	594.23	647.07	672.24	652.82	629.12	603.88	573.34	510.13	445.72	418.78	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.86	0.72	0.53	0.39	0.42	0.64	0.89	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.08	20.28	20.53	20.78	20.93	20.99	21	21	20.97	20.77	20.38	20.04	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.02	20.02	20.02	20.04	20.04	20.05	20.05	20.05	20.04	20.04	20.03	20.03	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.83	0.66	0.46	0.3	0.33	0.56	0.86	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.81	19.1	19.45	19.8	19.98	20.04	20.05	20.05	20.02	19.8	19.26	18.77	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.45	19.69	19.99	20.29	20.46	20.52	20.52	20.52	20.5	20.29	19.82	19.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.45	19.69	19.99	20.29	20.46	20.52	20.52	20.52	20.5	20.29	19.82	19.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.93	0.84	0.69	0.5	0.34	0.38	0.6	0.87	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	437.72	509.48	551.08	541.99	461.87	323.15	216.42	226.75	344.68	442.59	431.72	414.11	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	864.76	842.07	766.07	638.57	489.64	326.99	216.85	227.44	355.27	541.6	714.65	858.71	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	317.72	223.5	159.95	69.54	20.66	0	0	0	0	73.67	203.71	330.78	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1399.53 | (98)

Space heating requirement in kWh/m²/year | 26.4 | (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system | 0 | (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =		1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =		1	(204)
Efficiency of main space heating system 1			93.5	(206)
Efficiency of secondary/supplementary heating system, %			0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	317.72	223.5	159.95	69.54	20.66	0	0	0	0	73.67	203.71	330.78		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	339.8	239.03	171.07	74.38	22.1	0	0	0	0	78.79	217.87	353.78		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1496.82	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	171.3	151.16	159.14	143.22	140.75	126.34	121.88	132.99	132.52	148.48	156.31	167.37		
Efficiency of water heater													79.8	(216)
(217)m=	86.44	85.86	84.83	83.01	81.03	79.8	79.8	79.8	79.8	83.06	85.52	86.6		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	198.17	176.06	187.61	172.53	173.71	158.32	152.73	166.65	166.06	178.77	182.77	193.27		
Total = Sum(219a)$_{1...12}$ =													2106.65	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1496.82	
Water heating fuel used			2106.65	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			244.75	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	323.31	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	455.04	(264)
Space and water heating	(261) + (262) + (263) + (264) =				778.35	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	127.02	(268)

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Total CO2, kg/year	sum of (265)…(271) =	944.3	(272)
TER =		17.81	(273)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-3-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	79.03	(1a) x	2.4	(2a) =	189.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.03	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	189.67	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 5			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Walls Type1	42.8	18.86	23.94	x	0.18	=	4.31			(29)
Walls Type2	13.9	2.1	11.8	x	0.18	=	2.12			(29)
Total area of elements, m²			56.7							(31)
Party wall			39.79	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.55 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.96 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 41.51 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	

Average = Sum(39)$_{1...12}$ /12= 72.8 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.44 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	101.47	97.78	94.09	90.4	86.71	83.02	83.02	86.71	90.4	94.09	97.78	101.47	

Total = Sum(44)$_{1...12}$ = 1107 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150.48	131.61	135.81	118.41	113.61	98.04	90.85	104.25	105.49	122.94	134.2	145.74	

Total = Sum(45)$_{1...12}$ = 1451.45 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.57	19.74	20.37	17.76	17.04	14.71	13.63	15.64	15.82	18.44	20.13	21.86	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.76	181.54	191.09	171.9	168.89	151.53	146.13	159.53	158.99	178.22	187.7	201.01	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.76	181.54	191.09	171.9	168.89	151.53	146.13	159.53	158.99	178.22	187.7	201.01

Output from water heater (annual)$_{1...12}$ | 2102.29 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	94.26	83.7	89.38	82.16	82	75.39	74.43	78.88	77.87	85.1	87.42	92.68	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.38	17.21	14	10.6	7.92	6.69	7.23	9.39	12.61	16.01	18.69	19.92	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	217.4	219.66	213.97	201.87	186.59	172.23	162.64	160.39	166.07	178.17	193.45	207.81	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	(71)

Water heating gains (Table 5)

(72)m=	126.69	124.56	120.13	114.12	110.21	104.71	100.04	106.03	108.16	114.38	121.41	124.57	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	423.14	421.09	407.77	386.25	364.39	343.3	329.57	335.47	346.5	368.23	393.21	411.96	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)

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South	0.9x	0.77	x	5.29	x	46.75	x	0.5	x	0.8	=	68.56	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	5.29	x	76.57	x	0.5	x	0.8	=	112.28	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	5.29	x	97.53	x	0.5	x	0.8	=	143.02	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	5.29	x	110.23	x	0.5	x	0.8	=	161.65	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	5.29	x	114.87	x	0.5	x	0.8	=	168.45	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	5.29	x	110.55	x	0.5	x	0.8	=	162.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	5.29	x	108.01	x	0.5	x	0.8	=	158.39	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	5.29	x	104.89	x	0.5	x	0.8	=	153.82	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	5.29	x	101.89	x	0.5	x	0.8	=	149.4	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	5.29	x	82.59	x	0.5	x	0.8	=	121.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	5.29	x	55.42	x	0.5	x	0.8	=	81.26	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	5.29	x	40.4	x	0.5	x	0.8	=	59.24	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)

West	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	183.92	315.17	433.45	536.24	596.58	589.6	569.61	525.59	469.52	349.2	220.71	157.09	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	607.06	736.27	841.22	922.49	960.97	932.9	899.18	861.06	816.01	717.43	613.92	569.06	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.84	0.68	0.5	0.36	0.39	0.6	0.88	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.24	20.44	20.67	20.87	20.97	21	21	21	20.99	20.84	20.49	20.19	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.8	0.62	0.43	0.29	0.32	0.53	0.84	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.15	19.43	19.75	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.51	19.07	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.58	19.83	20.12	20.35	20.46	20.49	20.49	20.49	20.48	20.33	19.9	19.51	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.58	19.83	20.12	20.35	20.46	20.49	20.49	20.49	20.48	20.33	19.9	19.51	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.81	0.64	0.46	0.31	0.35	0.56	0.85	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	599.79	712	772.01	747.93	618.51	426.4	282.98	297.38	457.58	611.34	596.03	564.17	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1112.65	1087.2	991.25	833.57	637.72	428.55	283.16	297.71	464.41	708.33	932.04	1114.93	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	381.57	252.14	163.12	61.66	14.29	0	0	0	0	72.16	241.92	409.77

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 1596.62 (98)

Space heating requirement in kWh/m²/year 20.2 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1596.62	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1257.34	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	419.11	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		2102.29	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1655.55	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	551.85	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	38.84	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		51.14	(330a)

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warm air heating system fans						0	(330b)
pump for solar water heating						0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =					51.14	(331)
Energy for lighting (calculated in Appendix L)						342.28	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	3308.79	x	0.22		714.7	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1058.81	x	0.52		-549.52	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4356.71	x	0.22		941.05	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1394.15	x	0.52		-723.56	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	225.51	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	20.16	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	628.33	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					628.33	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	26.54	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	177.64	(379)
Total CO2, kg/year	sum of (376)…(382) =					832.52	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					10.53	(384)
EI rating (section 14)						91.01	(385)

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TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-3-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	79.03	(1a) x	2.4	(2a) =	189.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.03	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	189.67	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30 ÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.43	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.58	x1/[1/(1.4)+ 0.04]		=	3.42			(27)
Windows Type 2			2.58	x1/[1/(1.4)+ 0.04]		=	3.42			(27)
Windows Type 3			2.58	x1/[1/(1.4)+ 0.04]		=	3.42			(27)
Windows Type 4			4.95	x1/[1/(1.4)+ 0.04]		=	6.56			(27)
Windows Type 5			4.95	x1/[1/(1.4)+ 0.04]		=	6.56			(27)
Walls Type1	42.8	17.64	25.16	x	0.18	=	4.53			(29)
Walls Type2	13.9	2.1	11.8	x	0.18	=	2.12			(29)
Total area of elements, m²			56.7							(31)
Party wall			39.79	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.14 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.58 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 37.72 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	37.42	37.18	36.95	35.85	35.65	34.7	34.7	34.52	35.06	35.65	36.06	36.5	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	75.14	74.9	74.67	73.57	73.37	72.41	72.41	72.24	72.78	73.37	73.78	74.22	

Average = Sum(39)$_{1...12}$ /12= 73.57 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.94	0.93	0.93	0.92	0.92	0.91	0.92	0.93	0.93	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.44 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	101.47	97.78	94.09	90.4	86.71	83.02	83.02	86.71	90.4	94.09	97.78	101.47	

Total = Sum(44)$_{1...12}$ = 1107 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150.48	131.61	135.81	118.41	113.61	98.04	90.85	104.25	105.49	122.94	134.2	145.74	

Total = Sum(45)$_{1...12}$ = 1451.45 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.57	19.74	20.37	17.76	17.04	14.71	13.63	15.64	15.82	18.44	20.13	21.86	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3												0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	197.08	173.7	182.41	163.5	160.21	143.13	137.44	150.84	150.59	169.54	179.29	192.33	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	197.08	173.7	182.41	163.5	160.21	143.13	137.44	150.84	150.59	169.54	179.29	192.33	
									Output from water heater (annual)$_{1...12}$				2000.06 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	87.31	77.43	82.43	75.44	75.05	68.67	67.48	71.94	71.15	78.15	80.7	85.73	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.38	17.21	14	10.6	7.92	6.69	7.23	9.39	12.61	16.01	18.69	19.92	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	217.4	219.66	213.97	201.87	186.59	172.23	162.64	160.39	166.07	178.17	193.45	207.81	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	(71)

Water heating gains (Table 5)

(72)m=	117.35	115.22	110.8	104.78	100.88	95.38	90.7	96.69	98.82	105.05	112.08	115.23	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	416.8	414.76	401.43	379.91	358.05	336.96	323.23	329.14	340.16	361.89	386.88	405.62	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	2.58	x	46.75	x	0.63	x	0.7	=	36.86	(78)
South	0.9x	0.77	x	2.58	x	46.75	x	0.63	x	0.7	=	36.86	(78)

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South	0.9x	0.77	x	4.95	x	46.75	x	0.63	x	0.7	=	70.73	(78)
South	0.9x	0.77	x	2.58	x	76.57	x	0.63	x	0.7	=	60.37	(78)
South	0.9x	0.77	x	2.58	x	76.57	x	0.63	x	0.7	=	60.37	(78)
South	0.9x	0.77	x	4.95	x	76.57	x	0.63	x	0.7	=	115.83	(78)
South	0.9x	0.77	x	2.58	x	97.53	x	0.63	x	0.7	=	76.9	(78)
South	0.9x	0.77	x	2.58	x	97.53	x	0.63	x	0.7	=	76.9	(78)
South	0.9x	0.77	x	4.95	x	97.53	x	0.63	x	0.7	=	147.55	(78)
South	0.9x	0.77	x	2.58	x	110.23	x	0.63	x	0.7	=	86.92	(78)
South	0.9x	0.77	x	2.58	x	110.23	x	0.63	x	0.7	=	86.92	(78)
South	0.9x	0.77	x	4.95	x	110.23	x	0.63	x	0.7	=	166.76	(78)
South	0.9x	0.77	x	2.58	x	114.87	x	0.63	x	0.7	=	90.57	(78)
South	0.9x	0.77	x	2.58	x	114.87	x	0.63	x	0.7	=	90.57	(78)
South	0.9x	0.77	x	4.95	x	114.87	x	0.63	x	0.7	=	173.78	(78)
South	0.9x	0.77	x	2.58	x	110.55	x	0.63	x	0.7	=	87.16	(78)
South	0.9x	0.77	x	2.58	x	110.55	x	0.63	x	0.7	=	87.16	(78)
South	0.9x	0.77	x	4.95	x	110.55	x	0.63	x	0.7	=	167.23	(78)
South	0.9x	0.77	x	2.58	x	108.01	x	0.63	x	0.7	=	85.17	(78)
South	0.9x	0.77	x	2.58	x	108.01	x	0.63	x	0.7	=	85.17	(78)
South	0.9x	0.77	x	4.95	x	108.01	x	0.63	x	0.7	=	163.4	(78)
South	0.9x	0.77	x	2.58	x	104.89	x	0.63	x	0.7	=	82.71	(78)
South	0.9x	0.77	x	2.58	x	104.89	x	0.63	x	0.7	=	82.71	(78)
South	0.9x	0.77	x	4.95	x	104.89	x	0.63	x	0.7	=	158.68	(78)
South	0.9x	0.77	x	2.58	x	101.89	x	0.63	x	0.7	=	80.33	(78)
South	0.9x	0.77	x	2.58	x	101.89	x	0.63	x	0.7	=	80.33	(78)
South	0.9x	0.77	x	4.95	x	101.89	x	0.63	x	0.7	=	154.13	(78)
South	0.9x	0.77	x	2.58	x	82.59	x	0.63	x	0.7	=	65.12	(78)
South	0.9x	0.77	x	2.58	x	82.59	x	0.63	x	0.7	=	65.12	(78)
South	0.9x	0.77	x	4.95	x	82.59	x	0.63	x	0.7	=	124.93	(78)
South	0.9x	0.77	x	2.58	x	55.42	x	0.63	x	0.7	=	43.7	(78)
South	0.9x	0.77	x	2.58	x	55.42	x	0.63	x	0.7	=	43.7	(78)
South	0.9x	0.77	x	4.95	x	55.42	x	0.63	x	0.7	=	83.83	(78)
South	0.9x	0.77	x	2.58	x	40.4	x	0.63	x	0.7	=	31.85	(78)
South	0.9x	0.77	x	2.58	x	40.4	x	0.63	x	0.7	=	31.85	(78)
South	0.9x	0.77	x	4.95	x	40.4	x	0.63	x	0.7	=	61.11	(78)
West	0.9x	0.77	x	2.58	x	19.64	x	0.63	x	0.7	=	15.49	(80)
West	0.9x	0.77	x	4.95	x	19.64	x	0.63	x	0.7	=	29.71	(80)
West	0.9x	0.77	x	2.58	x	38.42	x	0.63	x	0.7	=	30.29	(80)
West	0.9x	0.77	x	4.95	x	38.42	x	0.63	x	0.7	=	58.12	(80)
West	0.9x	0.77	x	2.58	x	63.27	x	0.63	x	0.7	=	49.89	(80)
West	0.9x	0.77	x	4.95	x	63.27	x	0.63	x	0.7	=	95.72	(80)
West	0.9x	0.77	x	2.58	x	92.28	x	0.63	x	0.7	=	72.76	(80)

West	0.9x	0.77	x	4.95	x	92.28	x	0.63	x	0.7	=	139.6	(80)
West	0.9x	0.77	x	2.58	x	113.09	x	0.63	x	0.7	=	89.17	(80)
West	0.9x	0.77	x	4.95	x	113.09	x	0.63	x	0.7	=	171.08	(80)
West	0.9x	0.77	x	2.58	x	115.77	x	0.63	x	0.7	=	91.28	(80)
West	0.9x	0.77	x	4.95	x	115.77	x	0.63	x	0.7	=	175.14	(80)
West	0.9x	0.77	x	2.58	x	110.22	x	0.63	x	0.7	=	86.91	(80)
West	0.9x	0.77	x	4.95	x	110.22	x	0.63	x	0.7	=	166.74	(80)
West	0.9x	0.77	x	2.58	x	94.68	x	0.63	x	0.7	=	74.65	(80)
West	0.9x	0.77	x	4.95	x	94.68	x	0.63	x	0.7	=	143.22	(80)
West	0.9x	0.77	x	2.58	x	73.59	x	0.63	x	0.7	=	58.02	(80)
West	0.9x	0.77	x	4.95	x	73.59	x	0.63	x	0.7	=	111.32	(80)
West	0.9x	0.77	x	2.58	x	45.59	x	0.63	x	0.7	=	35.95	(80)
West	0.9x	0.77	x	4.95	x	45.59	x	0.63	x	0.7	=	68.97	(80)
West	0.9x	0.77	x	2.58	x	24.49	x	0.63	x	0.7	=	19.31	(80)
West	0.9x	0.77	x	4.95	x	24.49	x	0.63	x	0.7	=	37.05	(80)
West	0.9x	0.77	x	2.58	x	16.15	x	0.63	x	0.7	=	12.73	(80)
West	0.9x	0.77	x	4.95	x	16.15	x	0.63	x	0.7	=	24.43	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	189.65	324.99	446.96	552.96	615.18	607.98	587.37	541.97	484.15	360.08	227.58	161.99	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	606.45	739.75	848.4	932.87	973.23	944.95	910.61	871.11	824.31	721.97	614.46	567.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.84	0.67	0.49	0.35	0.38	0.6	0.88	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.2	20.4	20.64	20.86	20.97	21	21	21	20.99	20.84	20.48	20.16	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.16	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.8	0.62	0.42	0.28	0.31	0.53	0.84	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.06	19.36	19.7	20	20.11	20.15	20.15	20.16	20.14	19.98	19.48	19.01	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.52	19.78	20.08	20.34	20.46	20.49	20.49	20.49	20.48	20.32	19.88	19.47	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.52	19.78	20.08	20.34	20.46	20.49	20.49	20.49	20.48	20.32	19.88	19.47	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.81	0.64	0.45	0.31	0.34	0.56	0.85	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	599.47	716.04	780.01	754.84	623.18	424.56	281.67	295.38	457.82	614.9	596.88	562.88	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1143.24	1114.53	1013.89	841.86	642.39	426.46	281.83	295.66	464.32	713.38	942.84	1133.37	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	404.57	267.78	174.01	62.65	14.29	0	0	0	0	73.27	249.09	424.45

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1670.12 (98)

Space heating requirement in kWh/m²/year 21.13 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	404.57	267.78	174.01	62.65	14.29	0	0	0	0	73.27	249.09	424.45	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	432.69	286.4	186.11	67.01	15.29	0	0	0	0	78.36	266.41	453.95	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1786.22 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	197.08	173.7	182.41	163.5	160.21	143.13	137.44	150.84	150.59	169.54	179.29	192.33

Efficiency of water heater 79.8 (216)

(217)m=	86.69	85.96	84.69	82.5	80.58	79.8	79.8	79.8	79.8	82.75	85.69	86.87	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	227.33	202.06	215.39	198.17	198.82	179.36	172.23	189.03	188.71	204.88	209.23	221.41

Total = Sum(219a)$_{1...12}$ = 2406.62 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1786.22
Water heating fuel used		2406.62
Electricity for pumps, fans and electric keep-hot		

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central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			342.28	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	385.82	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	519.83	(264)
Space and water heating	(261) + (262) + (263) + (264) =			905.65	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	177.64	(268)
Total CO2, kg/year		sum of (265)…(271) =		1122.22	(272)

TER = 14.2 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-3-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	105.24	(1a) x	2.4	(2a) =	252.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	105.24	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	252.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 5			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Walls Type1	30.46	12.88	17.58	x	0.18	=	3.16			(29)
Walls Type2	29.12	2.1	27.02	x	0.18	=	4.86			(29)
Total area of elements, m²			59.58							(31)
Party wall			42.26	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.14 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 36.43 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.11	78.11	78.11	78.11	78.11	78.11	78.11	78.11	78.11	78.11	78.11	78.11	

Average = Sum(39)$_{1...12}$ /12= 78.11 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74

Average = Sum(40)$_{1...12}$ /12= 0.74 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.78 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 100.3 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	110.33	106.31	102.3	98.29	94.28	90.27	90.27	94.28	98.29	102.3	106.31	110.33

Total = Sum(44)$_{1...12}$ = 1203.56 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	163.61	143.1	147.66	128.73	123.52	106.59	98.77	113.34	114.7	133.67	145.91	158.45

Total = Sum(45)$_{1...12}$ = 1578.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.54	21.46	22.15	19.31	18.53	15.99	14.82	17	17.2	20.05	21.89	23.77	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	218.89	193.02	202.94	182.23	178.8	160.09	154.05	168.62	168.19	188.95	199.4	213.73	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	218.89	193.02	202.94	182.23	178.8	160.09	154.05	168.62	168.19	188.95	199.4	213.73

Output from water heater (annual)$_{1...12}$ | 2228.9 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	98.62	87.52	93.32	85.6	85.29	78.24	77.06	81.91	80.93	88.67	91.31	96.91	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.31	22.48	18.28	13.84	10.34	8.73	9.44	12.27	16.46	20.9	24.4	26.01	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	264.53	267.28	260.36	245.63	227.04	209.57	197.9	195.16	202.07	216.8	235.39	252.86	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	(71)

Water heating gains (Table 5)

(72)m=	132.56	130.24	125.43	118.89	114.64	108.66	103.58	110.09	112.41	119.18	126.82	130.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	487.14	484.74	468.81	443.1	416.77	391.71	375.66	382.26	395.69	421.62	451.35	473.86	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)

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West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)

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West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)

DRAFT

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	70.12	137.17	225.91	329.47	403.78	413.34	393.52	338.02	262.74	162.77	87.43	57.67	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	557.26	621.91	694.72	772.58	820.55	805.05	769.18	720.28	658.43	584.39	538.79	531.53	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.82	0.61	0.45	0.5	0.78	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.28	20.39	20.57	20.79	20.95	20.99	21	21	20.97	20.76	20.47	20.25	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.98	0.93	0.78	0.55	0.38	0.42	0.71	0.96	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.32	19.48	19.75	20.06	20.25	20.3	20.3	20.3	20.28	20.03	19.6	19.28	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.61	19.75	19.99	20.28	20.46	20.51	20.51	20.51	20.49	20.25	19.86	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.61	19.75	19.99	20.28	20.46	20.51	20.51	20.51	20.49	20.25	19.86	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.79	0.57	0.4	0.45	0.73	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	556.08	618.73	682.74	719.13	644.99	457.92	305.35	320.65	480.96	560.63	535.89	530.71	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1195.88	1159.99	1054	889.01	684.36	461.46	305.58	321.17	499.06	753.55	997.03	1200.37	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	476.02	363.73	276.22	122.31	29.29	0	0	0	0	143.53	332.02	498.23	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2241.34 (98)

Space heating requirement in kWh/m²/year 21.3 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP 0.75 (303a)

Fraction of community heat from heat source 2 0.25 (303b)

Fraction of total space heat from Community CHP (302) x (303a) = 0.75 (304a)

Fraction of total space heat from community heat source 2 (302) x (303b) = 0.25 (304b)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 2241.34

Space heat from Community CHP (98) x (304a) x (305) x (306) = 1765.06 (307a)

Space heat from heat source 2 (98) x (304b) x (305) x (306) = 588.35 (307b)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 2228.9

If DHW from community scheme:

Water heat from Community CHP (64) x (303a) x (305) x (306) = 1755.26 (310a)

Water heat from heat source 2 (64) x (303b) x (305) x (306) = 585.09 (310b)

Electricity used for heat distribution 0.01 × [(307a)…(307e) + (310a)…(310e)] = 46.94 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside 68.1 (330a)

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warm air heating system fans					0	(330b)
pump for solar water heating					0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =				68.1	(331)
Energy for lighting (calculated in Appendix L)					446.9	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit					32	(361)
Heat efficiency of CHP unit					38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**	**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4644.88	x	0.22	1003.29	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1486.36	x	0.52	-771.42	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4619.1	x	0.22	997.73	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1478.11	x	0.52	-767.14	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22 =	272.54	(368)
Electrical energy for heat distribution	[(313) x			0.52 =	24.36	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)			=	759.36	(373)
CO2 associated with space heating (secondary)	(309) x			0 =	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22 =	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				759.36	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52 =	35.34	(378)
CO2 associated with electricity for lighting	(332))) x			0.52 =	231.94	(379)
Total CO2, kg/year	sum of (376)…(382) =				1026.65	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				9.76	(384)
EI rating (section 14)					90.84	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-3-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	105.24	(1a) x	2.4	(2a) =	252.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	105.24	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		252.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.43	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 4			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 5			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Walls Type1	30.46	12.88	17.58	x	0.18	=	3.16			(29)
Walls Type2	29.12	2.1	27.02	x	0.18	=	4.86			(29)
Total area of elements, m²			59.58							(31)
Party wall			42.26	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 27.2 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.51 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 32.71 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	49.84	49.52	49.21	47.75	47.48	46.21	46.21	45.97	46.7	47.48	48.03	48.61	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	82.55	82.23	81.92	80.46	80.19	78.92	78.92	78.68	79.41	80.19	80.74	81.32	

Average = Sum(39)$_{1...12}$ /12= 80.46 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.78	0.78	0.78	0.76	0.76	0.75	0.75	0.75	0.75	0.76	0.77	0.77	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.78 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 100.3 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	110.33	106.31	102.3	98.29	94.28	90.27	90.27	94.28	98.29	102.3	106.31	110.33	

Total = Sum(44)$_{1...12}$ = 1203.56 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	163.61	143.1	147.66	128.73	123.52	106.59	98.77	113.34	114.7	133.67	145.91	158.45	

Total = Sum(45)$_{1...12}$ = 1578.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.54	21.46	22.15	19.31	18.53	15.99	14.82	17	17.2	20.05	21.89	23.77	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.21	185.18	194.26	173.83	170.12	151.68	145.37	159.94	159.79	180.26	191	205.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	210.21	185.18	194.26	173.83	170.12	151.68	145.37	159.94	159.79	180.26	191	205.04

Output from water heater (annual)$_{1...12}$	2126.68	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.68	81.25	86.37	78.88	78.35	71.52	70.12	74.96	74.21	81.72	84.59	89.96	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	26.06	23.15	18.83	14.25	10.65	8.99	9.72	12.63	16.96	21.53	25.13	26.79	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	264.53	267.28	260.36	245.63	227.04	209.57	197.9	195.16	202.07	216.8	235.39	252.86	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	(71)

Water heating gains (Table 5)

(72)m=	123.22	120.9	116.09	109.55	105.31	99.33	94.24	100.76	103.07	109.84	117.48	120.91	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	481.56	479.07	463.02	437.18	410.75	385.64	369.61	376.29	389.84	415.91	445.75	468.31	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)

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West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)

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West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	77.31	151.23	249.06	363.24	445.17	455.71	433.85	372.67	289.67	179.45	96.4	63.58	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	558.87	630.31	712.09	800.42	855.92	841.35	803.46	748.96	679.51	595.37	542.14	531.88	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.94	0.81	0.59	0.43	0.48	0.77	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.22	20.33	20.54	20.79	20.95	20.99	21	21	20.97	20.75	20.44	20.2	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.27	20.27	20.27	20.28	20.29	20.3	20.3	20.3	20.29	20.29	20.28	20.28	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.98	0.93	0.76	0.53	0.36	0.41	0.7	0.96	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.2	19.38	19.67	20.04	20.24	20.29	20.3	20.3	20.27	20	19.54	19.19	(90)

fLA = Living area ÷ (4) = | 0.3 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.51	19.67	19.93	20.26	20.45	20.5	20.51	20.51	20.48	20.22	19.81	19.49	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.51	19.67	19.93	20.26	20.45	20.5	20.51	20.51	20.48	20.22	19.81	19.49	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.93	0.77	0.55	0.38	0.43	0.72	0.96	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	557.7	627.06	699.47	741.13	662.9	462.91	308.18	322.84	489.32	570.63	539.26	531.08	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1255.27	1214.15	1100.37	914.39	701.69	465.93	308.38	323.28	506.83	771.79	1026.53	1243.47	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	518.99	394.53	298.27	124.75	28.86	0	0	0	0	149.66	350.84	530.02

Total per year (kWh/year) = Sum(98)$_{1\ldots5,9\ldots12}$ = 2395.91 (98)

Space heating requirement in kWh/m²/year 22.77 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	518.99	394.53	298.27	124.75	28.86	0	0	0	0	149.66	350.84	530.02		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	555.06	421.95	319.01	133.42	30.87	0	0	0	0	160.06	375.23	566.87		(211)

Total (kWh/year) =Sum(211)$_{1\ldots5,10\ldots12}$= 2562.47 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1\ldots5,10\ldots12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	210.21	185.18	194.26	173.83	170.12	151.68	145.37	159.94	159.79	180.26	191	205.04

Efficiency of water heater 79.8 (216)

(217)m=	87.13	86.78	85.95	83.95	81.19	79.8	79.8	79.8	79.8	84.32	86.42	87.24	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	241.25	213.38	226	207.07	209.53	190.08	182.17	200.42	200.24	213.78	221.03	235.04

Total = Sum(219a)$_{1\ldots12}$ = 2539.98 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2562.47
Water heating fuel used		2539.98
Electricity for pumps, fans and electric keep-hot		

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central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			460.27	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	553.49	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	548.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1102.13	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	238.88	(268)
Total CO2, kg/year			sum of (265)…(271) =		1379.94	(272)

TER = 13.11 (273)

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User Details:

Assessor Name: | **Stroma Number:**

Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-3-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.91	(1a) x	2.4	(2a) =	208.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.91	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	208.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 4			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 5			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Walls Type1	47.44	17.25	30.19	x	0.18	=	5.43			(29)
Walls Type2	10.78	2.1	8.68	x	0.18	=	1.56			(29)
Total area of elements, m²			58.22							(31)
Party wall			48.43	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 29.27 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.85 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 42.12 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.54	76.54	76.54	76.54	76.54	76.54	76.54	76.54	76.54	76.54	76.54	76.54	

Average = Sum(39)$_{1\ldots12}$ /12= 76.54 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88

Average = Sum(40)$_{1\ldots12}$ /12= 0.88 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.58 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.5 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	105.05	101.23	97.41	93.59	89.77	85.95	85.95	89.77	93.59	97.41	101.23	105.05

Total = Sum(44)$_{1\ldots12}$ = 1145.99 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.78	136.25	140.6	122.58	117.62	101.49	94.05	107.92	109.21	127.27	138.93	150.87

Total = Sum(45)$_{1\ldots12}$ = 1502.57 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.37	20.44	21.09	18.39	17.64	15.22	14.11	16.19	16.38	19.09	20.84	22.63	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.06	186.18	195.88	176.07	172.89	154.99	149.33	163.2	162.7	182.55	192.42	206.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.06	186.18	195.88	176.07	172.89	154.99	149.33	163.2	162.7	182.55	192.42	206.15	

Output from water heater (annual)$_{1\ldots12}$	2153.41	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	96.02	85.25	90.97	83.55	83.33	76.54	75.49	80.11	79.11	86.54	88.99	94.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.79	18.47	15.02	11.37	8.5	7.18	7.75	10.08	13.53	17.18	20.05	21.37	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	233.28	235.7	229.6	216.61	200.22	184.81	174.52	172.1	178.2	191.18	207.58	222.98	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	(71)

Water heating gains (Table 5)

(72)m=	129.06	126.85	122.27	116.04	112	106.31	101.47	107.67	109.87	116.32	123.6	126.86	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	444.84	442.73	428.6	405.74	382.43	360.01	345.46	351.56	363.31	386.39	412.94	432.93	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)

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North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)

West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	80.71	157.17	260.4	387.27	484.5	501.1	474.91	400.76	304.85	186.61	100.42	66.55	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	525.55	599.91	689.01	793.01	866.93	861.11	820.37	752.32	668.16	573.01	513.36	499.48	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.76	0.56	0.41	0.47	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.14	20.28	20.51	20.78	20.94	20.99	21	21	20.96	20.72	20.37	20.11	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.71	0.49	0.33	0.38	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.03	19.23	19.56	19.93	20.13	20.18	20.18	20.18	20.16	19.86	19.37	18.98	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.48	19.65	19.94	20.27	20.46	20.5	20.51	20.51	20.48	20.21	19.77	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.48	19.65	19.94	20.27	20.46	20.5	20.51	20.51	20.48	20.21	19.77	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.73	0.52	0.36	0.42	0.7	0.94	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	523.53	594.47	669.39	712.75	634.34	448.1	298.9	313.73	467.74	541.23	508.79	498.05	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1161.61	1128.77	1028.45	870.09	670.31	451.94	299.25	314.51	488.34	735.26	969.56	1165.57	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	474.73	359.05	267.14	113.28	26.76	0	0	0	0	144.35	331.75	496.63

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 2213.7 (98)

Space heating requirement in kWh/m²/year 25.47 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

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Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2213.7	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1743.29	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	581.1	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2153.41	
If DHW from community scheme:			
Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1695.81	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	565.27	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	45.85	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		56.24	(330a)

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warm air heating system fans						0	(330b)
pump for solar water heating						0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =					56.24	(331)
Energy for lighting (calculated in Appendix L)						367.2	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4587.6	x	0.22		990.92	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1468.03	x	0.52		-761.91	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4462.67	x	0.22		963.94	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1428.05	x	0.52		-741.16	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	266.25	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	23.8	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	741.84	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					741.84	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	29.19	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	190.58	(379)
Total CO2, kg/year	sum of (376)…(382) =					961.61	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					11.06	(384)
EI rating (section 14)						90.23	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-3-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.91	(1a) x	2.4	(2a) =	208.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.91	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	208.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.39	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 4			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 5			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Walls Type1	47.44	17.25	30.19	x	0.18	=	5.43			(29)
Walls Type2	10.78	2.1	8.68	x	0.18	=	1.56			(29)
Total area of elements, m²			58.22							(31)
Party wall			48.43	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.97 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.48 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 37.45 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(38)m=	40.69	40.44	40.2	39.08	38.87	37.9	37.9	37.72	38.27	38.87	39.3	39.74	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.13	77.89	77.65	76.53	76.32	75.35	75.35	75.16	75.72	76.32	76.75	77.19	

Average = $Sum(39)_{1...12}$ /12= 76.53 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.9	0.9	0.89	0.88	0.88	0.87	0.87	0.86	0.87	0.88	0.88	0.89	

Average = $Sum(40)_{1...12}$ /12= 0.88 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.58 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.5 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	105.05	101.23	97.41	93.59	89.77	85.95	85.95	89.77	93.59	97.41	101.23	105.05	

Total = $Sum(44)_{1...12}$ = 1145.99 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.78	136.25	140.6	122.58	117.62	101.49	94.05	107.92	109.21	127.27	138.93	150.87	

Total = $Sum(45)_{1...12}$ = 1502.57 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.37	20.44	21.09	18.39	17.64	15.22	14.11	16.19	16.38	19.09	20.84	22.63	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3												0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.38	178.34	187.19	167.67	164.21	146.59	140.64	154.52	154.3	173.87	184.02	197.46	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.38	178.34	187.19	167.67	164.21	146.59	140.64	154.52	154.3	173.87	184.02	197.46	
									Output from water heater (annual)$_{1...12}$			2051.19	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.07	78.97	84.02	76.83	76.38	69.82	68.55	73.16	72.39	79.59	82.27	87.44	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	20.96	18.62	15.14	11.46	8.57	7.23	7.82	10.16	13.64	17.31	20.21	21.54	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	233.28	235.7	229.6	216.61	200.22	184.81	174.52	172.1	178.2	191.18	207.58	222.98	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	(71)
Water heating gains (Table 5)													
(72)m=	119.72	117.52	112.94	106.71	102.67	96.97	92.13	98.33	100.54	106.98	114.26	117.53	(72)
Total internal gains =						(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m							
(73)m=	438.68	436.55	422.39	399.5	376.17	353.73	339.18	345.31	357.09	380.2	406.76	426.77	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.29	x	10.63	x	0.63	x	0.7	=	17.19	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.63	x	0.7	=	32.85	(74)

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North	0.9x	0.77	x	5.29	x	34.53	x	0.63	x	0.7	=	55.82	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.63	x	0.7	=	89.67	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.63	x	0.7	=	120.79	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.63	x	0.7	=	129.31	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.63	x	0.7	=	120.73	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.63	x	0.7	=	95.78	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.63	x	0.7	=	67.12	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.63	x	0.7	=	39.11	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.63	x	0.7	=	21.21	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.63	x	0.7	=	14.33	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)

West	0.9x	0.77	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	88.98	173.28	287.1	426.96	534.16	552.47	523.59	441.84	336.1	205.74	110.72	73.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	527.65	609.83	709.49	826.46	910.33	906.2	862.77	787.14	693.18	585.94	517.48	500.13	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.74	0.53	0.38	0.44	0.72	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.12	20.27	20.51	20.8	20.96	21	21	21	20.97	20.73	20.37	20.1	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.17	20.18	20.19	20.2	20.2	20.2	20.19	20.19	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.46	0.31	0.36	0.65	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.98	19.2	19.55	19.96	20.15	20.19	20.2	20.2	20.17	19.88	19.37	18.96	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.63	19.94	20.29	20.47	20.51	20.52	20.52	20.49	20.22	19.77	19.41	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.63	19.94	20.29	20.47	20.51	20.52	20.52	20.49	20.22	19.77	19.41	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.88	0.7	0.49	0.34	0.39	0.67	0.94	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	525.61	603.96	687.16	730.77	640.49	443.04	294.92	309	467.68	550.33	512.71	498.7	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1182.8	1147.08	1043.37	872.01	669.32	445.57	295.13	309.5	483.97	734.5	972.26	1174.23	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	488.95	364.98	265.02	101.69	21.45	0	0	0	0	137.02	330.88	502.59

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2212.58 (98)

Space heating requirement in kWh/m²/year 25.46 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	488.95	364.98	265.02	101.69	21.45	0	0	0	0	137.02	330.88	502.59	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	522.95	390.35	283.44	108.76	22.94	0	0	0	0	146.55	353.88	537.53	(211)

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2366.4 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

202.38	178.34	187.19	167.67	164.21	146.59	140.64	154.52	154.3	173.87	184.02	197.46

Efficiency of water heater 79.8 (216)

(217)m=	87.08	86.68	85.74	83.53	80.91	79.8	79.8	79.8	79.8	84.19	86.36	87.2	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	232.4	205.73	218.32	200.73	202.97	183.69	176.24	193.63	193.36	206.53	213.08	226.44

Total = Sum(219a)$_{1...12}$ = 2453.14 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2366.4
Water heating fuel used		2453.14
Electricity for pumps, fans and electric keep-hot		

central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			370.17	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	511.14	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	529.88	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1041.02	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	192.12	(268)
Total CO2, kg/year		sum of (265)…(271) =		1272.06	(272)

TER = 14.64 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-6-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.18	(1a) x	2.4	(2a) =	170.83	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.18	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.83	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			8.05	x1/[1/(1.2)+ 0.04]		=	9.22			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	39.96	17.02	22.94	x	0.18	=	4.13			(29)
Walls Type2	5.87	2.1	3.77	x	0.18	=	0.68			(29)
Total area of elements, m²			45.83							(31)
Party wall			39.46	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	26.82	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		10.1	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	36.92	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	65.11	65.11	65.11	65.11	65.11	65.11	65.11	65.11	65.11	65.11	65.11	65.11

Average = Sum(39)$_{1\ldots12}$ /12= 65.11 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.27 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	97.04	93.51	89.98	86.45	82.92	79.4	79.4	82.92	86.45	89.98	93.51	97.04

Total = Sum(44)$_{1...12}$ = 1058.61 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.91	125.86	129.88	113.23	108.65	93.75	86.88	99.69	100.88	117.57	128.34	139.37

Total = Sum(45)$_{1...12}$ = 1388.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.59	18.88	19.48	16.98	16.3	14.06	13.03	14.95	15.13	17.64	19.25	20.9	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.18	175.79	185.15	166.72	163.92	147.25	142.15	154.97	154.38	172.85	181.83	194.64	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.18	175.79	185.15	166.72	163.92	147.25	142.15	154.97	154.38	172.85	181.83	194.64	

Output from water heater (annual)$_{1…12}$ 2038.85 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.07	81.79	87.41	80.44	80.35	73.97	73.11	77.37	76.34	83.31	85.47	90.56	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.83	15.84	12.88	9.75	7.29	6.15	6.65	8.64	11.6	14.73	17.19	18.33	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.04	202.11	196.88	185.74	171.69	158.48	149.65	147.57	152.81	163.94	178	191.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	(71)

Water heating gains (Table 5)

(72)m=	123.75	121.71	117.48	111.73	107.99	102.73	98.26	103.99	106.03	111.98	118.7	121.72	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	398.74	396.78	384.36	364.34	344.09	324.48	311.68	317.33	327.55	347.77	371.01	388.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)

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North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
East	0.9x	1	x	8.05	x	19.64	x	0.5	x	0.8	=	43.83	(76)
East	0.9x	1	x	8.05	x	38.42	x	0.5	x	0.8	=	85.73	(76)
East	0.9x	1	x	8.05	x	63.27	x	0.5	x	0.8	=	141.19	(76)
East	0.9x	1	x	8.05	x	92.28	x	0.5	x	0.8	=	205.92	(76)
East	0.9x	1	x	8.05	x	113.09	x	0.5	x	0.8	=	252.36	(76)
East	0.9x	1	x	8.05	x	115.77	x	0.5	x	0.8	=	258.34	(76)
East	0.9x	1	x	8.05	x	110.22	x	0.5	x	0.8	=	245.95	(76)
East	0.9x	1	x	8.05	x	94.68	x	0.5	x	0.8	=	211.27	(76)
East	0.9x	1	x	8.05	x	73.59	x	0.5	x	0.8	=	164.21	(76)
East	0.9x	1	x	8.05	x	45.59	x	0.5	x	0.8	=	101.73	(76)

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East	0.9x	1	x	8.05	x	24.49	x	0.5	x	0.8	=	54.65	(76)
East	0.9x	1	x	8.05	x	16.15	x	0.5	x	0.8	=	36.04	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	70.27	136.26	227.05	343.83	438.14	457.22	431.63	358.58	267.44	161.88	87.26	58.08	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	469	533.04	611.41	708.17	782.23	781.7	743.31	675.91	594.99	509.65	458.28	446.46	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.73	0.53	0.38	0.44	0.72	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.28	20.52	20.79	20.95	20.99	21	21	20.97	20.73	20.38	20.11	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.16	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.87	0.68	0.46	0.31	0.36	0.64	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.01	19.21	19.55	19.92	20.11	20.15	20.15	20.15	20.13	19.85	19.35	18.96	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.47	19.64	19.94	20.27	20.45	20.49	20.49	20.49	20.47	20.21	19.76	19.42	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.47	19.64	19.94	20.27	20.45	20.49	20.49	20.49	20.47	20.21	19.76	19.42	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.96	0.88	0.7	0.49	0.34	0.39	0.67	0.93	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	466.29	526.23	588.62	620.86	544.25	380.76	253.19	265.84	399.24	473.96	452.39	444.49	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	987.43	959.81	874.94	740.32	569.57	383.38	253.43	266.41	414.48	625.41	824.51	990.67	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	387.73	291.37	213.03	86.01	18.84	0	0	0	0	112.68	267.93	406.35	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 1783.94 (98)

Space heating requirement in kWh/m²/year 25.06 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1783.94	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1404.85	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	468.28	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		2038.85	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1605.59	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	535.2	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	40.14	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.06	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	46.06	(331)
Energy for lighting (calculated in Appendix L)		314.94	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	3696.98	x	0.22	798.55	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1183.03	x	0.52	-613.99	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4225.24	x	0.22	912.65	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1352.08	x	0.52	-701.73	(366)

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Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	233.07	(368)
Electrical energy for heat distribution	[(313) x	0.52	=	20.83	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	649.38	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			649.38	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	23.9	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	163.45	(379)
Total CO2, kg/year	sum of (376)…(382) =			836.74	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			11.76	(384)
EI rating (section 14)				90.35	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-6-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.18	(1a) x	2.4	(2a) =	170.83	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.18	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.83	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.43	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.88	x1/[1/(1.4)+ 0.04]		=	6.47			(27)
Windows Type 2			1.7	x1/[1/(1.4)+ 0.04]		=	2.25			(27)
Windows Type 3			7.42	x1/[1/(1.4)+ 0.04]		=	9.84			(27)
Windows Type 4			1.7	x1/[1/(1.4)+ 0.04]		=	2.25			(27)
Walls Type1	39.96	15.7	24.26	x	0.18	=	4.37			(29)
Walls Type2	5.87	2.1	3.77	x	0.18	=	0.68			(29)
Total area of elements, m²			45.83							(31)
Party wall			39.46	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	27.96	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		4.2	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	32.16	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.18	33.95	33.72	32.65	32.45	31.52	31.52	31.34	31.88	32.45	32.86	33.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	66.35	66.11	65.89	64.81	64.61	63.68	63.68	63.51	64.04	64.61	65.02	65.44	

Average = Sum(39)$_{1…12}$ /12= 64.81 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.91	0.91	0.89	0.89	0.89	0.9	0.91	0.91	0.92

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.27 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.04	93.51	89.98	86.45	82.92	79.4	79.4	82.92	86.45	89.98	93.51	97.04

Total = Sum(44)$_{1...12}$ = 1058.61 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.91	125.86	129.88	113.23	108.65	93.75	86.88	99.69	100.88	117.57	128.34	139.37

Total = Sum(45)$_{1...12}$ = 1388.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.59	18.88	19.48	16.98	16.3	14.06	13.03	14.95	15.13	17.64	19.25	20.9	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	190.5	167.95	176.47	158.32	155.24	138.85	133.47	146.29	145.98	164.17	173.43	185.96	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	190.5	167.95	176.47	158.32	155.24	138.85	133.47	146.29	145.98	164.17	173.43	185.96	

Output from water heater (annual)$_{1...12}$ 1936.62 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.12	75.52	80.46	73.72	73.4	67.25	66.16	70.42	69.62	76.37	78.75	83.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.84	15.84	12.88	9.75	7.29	6.16	6.65	8.65	11.6	14.74	17.2	18.33	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.04	202.11	196.88	185.74	171.69	158.48	149.65	147.57	152.81	163.94	178	191.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	(71)

Water heating gains (Table 5)

(72)m=	114.42	112.38	108.15	102.39	98.66	93.4	88.93	94.66	96.69	102.65	109.37	112.39	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	392.4	390.45	378.03	358.01	337.75	318.15	305.35	310.99	321.22	341.44	364.68	382.05	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.88	x	10.63	x	0.63	x	0.7	=	15.86	(74)
North	0.9x	0.77	x	1.7	x	10.63	x	0.63	x	0.7	=	5.52	(74)
North	0.9x	0.77	x	1.7	x	10.63	x	0.63	x	0.7	=	5.52	(74)
North	0.9x	0.77	x	4.88	x	20.32	x	0.63	x	0.7	=	30.31	(74)
North	0.9x	0.77	x	1.7	x	20.32	x	0.63	x	0.7	=	10.56	(74)

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North	0.9x	0.77	x	1.7	x	20.32	x	0.63	x	0.7	=	10.56	(74)
North	0.9x	0.77	x	4.88	x	34.53	x	0.63	x	0.7	=	51.5	(74)
North	0.9x	0.77	x	1.7	x	34.53	x	0.63	x	0.7	=	17.94	(74)
North	0.9x	0.77	x	1.7	x	34.53	x	0.63	x	0.7	=	17.94	(74)
North	0.9x	0.77	x	4.88	x	55.46	x	0.63	x	0.7	=	82.72	(74)
North	0.9x	0.77	x	1.7	x	55.46	x	0.63	x	0.7	=	28.82	(74)
North	0.9x	0.77	x	1.7	x	55.46	x	0.63	x	0.7	=	28.82	(74)
North	0.9x	0.77	x	4.88	x	74.72	x	0.63	x	0.7	=	111.43	(74)
North	0.9x	0.77	x	1.7	x	74.72	x	0.63	x	0.7	=	38.82	(74)
North	0.9x	0.77	x	1.7	x	74.72	x	0.63	x	0.7	=	38.82	(74)
North	0.9x	0.77	x	4.88	x	79.99	x	0.63	x	0.7	=	119.29	(74)
North	0.9x	0.77	x	1.7	x	79.99	x	0.63	x	0.7	=	41.56	(74)
North	0.9x	0.77	x	1.7	x	79.99	x	0.63	x	0.7	=	41.56	(74)
North	0.9x	0.77	x	4.88	x	74.68	x	0.63	x	0.7	=	111.37	(74)
North	0.9x	0.77	x	1.7	x	74.68	x	0.63	x	0.7	=	38.8	(74)
North	0.9x	0.77	x	1.7	x	74.68	x	0.63	x	0.7	=	38.8	(74)
North	0.9x	0.77	x	4.88	x	59.25	x	0.63	x	0.7	=	88.36	(74)
North	0.9x	0.77	x	1.7	x	59.25	x	0.63	x	0.7	=	30.78	(74)
North	0.9x	0.77	x	1.7	x	59.25	x	0.63	x	0.7	=	30.78	(74)
North	0.9x	0.77	x	4.88	x	41.52	x	0.63	x	0.7	=	61.92	(74)
North	0.9x	0.77	x	1.7	x	41.52	x	0.63	x	0.7	=	21.57	(74)
North	0.9x	0.77	x	1.7	x	41.52	x	0.63	x	0.7	=	21.57	(74)
North	0.9x	0.77	x	4.88	x	24.19	x	0.63	x	0.7	=	36.08	(74)
North	0.9x	0.77	x	1.7	x	24.19	x	0.63	x	0.7	=	12.57	(74)
North	0.9x	0.77	x	1.7	x	24.19	x	0.63	x	0.7	=	12.57	(74)
North	0.9x	0.77	x	4.88	x	13.12	x	0.63	x	0.7	=	19.56	(74)
North	0.9x	0.77	x	1.7	x	13.12	x	0.63	x	0.7	=	6.82	(74)
North	0.9x	0.77	x	1.7	x	13.12	x	0.63	x	0.7	=	6.82	(74)
North	0.9x	0.77	x	4.88	x	8.86	x	0.63	x	0.7	=	13.22	(74)
North	0.9x	0.77	x	1.7	x	8.86	x	0.63	x	0.7	=	4.61	(74)
North	0.9x	0.77	x	1.7	x	8.86	x	0.63	x	0.7	=	4.61	(74)
East	0.9x	1	x	7.42	x	19.64	x	0.63	x	0.7	=	44.54	(76)
East	0.9x	1	x	7.42	x	38.42	x	0.63	x	0.7	=	87.12	(76)
East	0.9x	1	x	7.42	x	63.27	x	0.63	x	0.7	=	143.48	(76)
East	0.9x	1	x	7.42	x	92.28	x	0.63	x	0.7	=	209.26	(76)
East	0.9x	1	x	7.42	x	113.09	x	0.63	x	0.7	=	256.45	(76)
East	0.9x	1	x	7.42	x	115.77	x	0.63	x	0.7	=	262.53	(76)
East	0.9x	1	x	7.42	x	110.22	x	0.63	x	0.7	=	249.94	(76)
East	0.9x	1	x	7.42	x	94.68	x	0.63	x	0.7	=	214.69	(76)
East	0.9x	1	x	7.42	x	73.59	x	0.63	x	0.7	=	166.87	(76)
East	0.9x	1	x	7.42	x	45.59	x	0.63	x	0.7	=	103.38	(76)

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East	0.9x	1	x	7.42	x	24.49	x	0.63	x	0.7	=	55.53	(76)
East	0.9x	1	x	7.42	x	16.15	x	0.63	x	0.7	=	36.63	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	71.44	138.55	230.86	349.61	445.52	464.93	438.9	364.61	271.93	164.59	88.73	59.06	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	463.85	528.99	608.89	707.62	783.27	783.07	744.25	675.61	593.15	506.03	453.41	441.1	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.73	0.52	0.38	0.43	0.71	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.26	20.5	20.8	20.95	21	21	21	20.97	20.74	20.37	20.09	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.15	20.16	20.16	20.17	20.17	20.17	20.17	20.16	20.16	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.87	0.67	0.45	0.31	0.35	0.64	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.95	19.17	19.52	19.93	20.12	20.17	20.17	20.17	20.15	19.86	19.35	18.93	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.42	19.6	19.91	20.28	20.45	20.5	20.5	20.5	20.48	20.21	19.76	19.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.42	19.6	19.91	20.28	20.45	20.5	20.5	20.5	20.48	20.21	19.76	19.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.96	0.88	0.69	0.48	0.33	0.39	0.67	0.93	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	461.34	522.58	587.03	619.8	541.69	373.57	248.34	260.17	394.55	470.98	447.86	439.28	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1003.04	972.16	883.73	737.36	565.64	375.68	248.53	260.61	408.33	621.06	823.04	994.48	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	403.03	302.11	220.75	84.64	17.82	0	0	0	0	111.66	270.13	413.07	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 1823.21 (98)

Space heating requirement in kWh/m²/year 25.61 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	403.03	302.11	220.75	84.64	17.82	0	0	0	0	111.66	270.13	413.07		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	431.05	323.12	236.09	90.53	19.06	0	0	0	0	119.42	288.91	441.79		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1949.96	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	190.5	167.95	176.47	158.32	155.24	138.85	133.47	146.29	145.98	164.17	173.43	185.96		
Efficiency of water heater													79.8	(216)
(217)m=	86.77	86.36	85.41	83.23	80.78	79.8	79.8	79.8	79.8	83.81	85.99	86.88		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	219.56	194.47	206.61	190.23	192.17	173.99	167.26	183.32	182.93	195.87	201.68	214.03		
Total = Sum(219a)$_{1...12}$ =													2322.13	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1949.96	
Water heating fuel used			2322.13	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			315.03	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	421.19	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	501.58	(264)
Space and water heating	(261) + (262) + (263) + (264) =				922.77	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	163.5	(268)

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Total CO2, kg/year	sum of (265)…(271) =	1125.19	(272)
TER =		15.81	(273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-6-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	69.44	(1a) x	2.4	(2a) =	166.66	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	69.44	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	166.66	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	43.96	14.72	29.24	x	0.18	=	5.26			(29)
Walls Type2	32.4	2.1	30.3	x	0.18	=	5.45			(29)
Total area of elements, m²			76.36							(31)
Party wall			14.75	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.09 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.72 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 41.81 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	

Average = Sum(39)$_{1...12}$ /12= 69.31 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	1	1	1	1	1	1	1	1	1	1	1

Average = Sum(40)$_{1...12}$ /12= 1 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.23 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	95.94	92.45	88.97	85.48	81.99	78.5	78.5	81.99	85.48	88.97	92.45	95.94	
										Total = Sum(44)$_{1...12}$ =		1046.65	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	142.28	124.44	128.41	111.95	107.42	92.7	85.9	98.57	99.74	116.24	126.89	137.79	
										Total = Sum(45)$_{1...12}$ =		1372.32	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	21.34	18.67	19.26	16.79	16.11	13.9	12.88	14.78	14.96	17.44	19.03	20.67	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	197.56	174.37	183.69	165.44	162.7	146.19	141.17	153.84	153.24	171.52	180.38	193.07	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	197.56	174.37	183.69	165.44	162.7	146.19	141.17	153.84	153.24	171.52	180.38	193.07	

Output from water heater (annual)$_{1...12}$	2023.16	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.53	81.32	86.92	80.02	79.94	73.62	72.78	76.99	75.96	82.87	84.98	90.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.47	15.52	12.62	9.55	7.14	6.03	6.52	8.47	11.37	14.43	16.85	17.96	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	195.99	198.02	192.9	181.98	168.21	155.27	146.62	144.59	149.71	160.62	174.4	187.34	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	(71)

Water heating gains (Table 5)

(72)m=	123.02	121.01	116.83	111.14	107.44	102.24	97.82	103.49	105.5	111.39	118.03	121.02	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	392.97	391.03	378.83	359.16	339.29	320.03	307.45	313.03	323.07	342.93	365.76	382.8	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)

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East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)

South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	149.28	254.06	345.55	422.33	466	459.07	444.11	412.37	372.43	280.37	178.8	127.74	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	542.25	645.09	724.38	781.49	805.28	779.1	751.55	725.4	695.5	623.3	544.56	510.54	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.88	0.74	0.56	0.4	0.44	0.66	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.14	20.33	20.56	20.79	20.93	20.99	21	21	20.97	20.78	20.4	20.09	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.94	0.85	0.69	0.48	0.32	0.35	0.58	0.87	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.95	19.22	19.55	19.85	20.03	20.08	20.08	20.08	20.07	19.85	19.33	18.87	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.43	19.66	19.95	20.23	20.39	20.44	20.45	20.45	20.43	20.22	19.76	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.43	19.66	19.95	20.23	20.39	20.44	20.45	20.45	20.43	20.22	19.76	19.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.93	0.85	0.7	0.51	0.35	0.39	0.61	0.88	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	535.81	626.54	676.49	665.26	567.7	400	266.34	279.85	425.99	546.36	529.93	506.02	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1048.33	1023.27	932.4	785.02	602.23	404.92	266.84	280.66	438.62	666.98	877.59	1050.69	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	381.32	266.6	190.4	86.23	25.69	0	0	0	0	89.74	250.32	405.23

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1695.52 (98)

Space heating requirement in kWh/m²/year 24.42 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1695.52	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1335.23	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	445.08	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		2023.16	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1593.24	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	531.08	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	39.05	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		44.93	(330a)

warm air heating system fans						0	(330b)
pump for solar water heating						0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =					44.93	(331)
Energy for lighting (calculated in Appendix L)						308.57	(332)

12b. CO_2 Emissions – Community heating scheme

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
Space heating from CHP)	(307a) × 100 ÷ (362) =	3513.75	x	0.22		758.97	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1124.4	x	0.52		-583.56	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4192.74	x	0.22		905.63	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1341.68	x	0.52		-696.33	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	226.72	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	20.26	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	631.69	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					631.69	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	23.32	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	160.15	(379)
Total CO2, kg/year	sum of (376)…(382) =					815.16	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					11.74	(384)
EI rating (section 14)						90.46	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-6-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	69.44	(1a) x	2.4	(2a) =	166.66	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	69.44	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	166.66	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.37	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.39	0.35	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 5			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	43.96	14.72	29.24	x	0.18	=	5.26			(29)
Walls Type2	32.4	2.1	30.3	x	0.18	=	5.45			(29)
Total area of elements, m²			76.36							(31)
Party wall			14.75	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	32.33	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		6.99	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	39.32	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	31.92	31.75	31.58	30.79	30.64	29.95	29.95	29.83	30.22	30.64	30.94	31.25	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	71.24	71.07	70.9	70.11	69.97	69.28	69.28	69.15	69.54	69.97	70.27	70.58	

Average = $Sum(39)_{1...12}$ /12= 70.11 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.03	1.02	1.02	1.01	1.01	1	1	1	1	1.01	1.01	1.02	

Average = $Sum(40)_{1...12}$ /12= 1.01 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.23 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	95.94	92.45	88.97	85.48	81.99	78.5	78.5	81.99	85.48	88.97	92.45	95.94	

Total = $Sum(44)_{1...12}$ = 1046.65 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	142.28	124.44	128.41	111.95	107.42	92.7	85.9	98.57	99.74	116.24	126.89	137.79	

Total = $Sum(45)_{1...12}$ = 1372.32 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.34	18.67	19.26	16.79	16.11	13.9	12.88	14.78	14.96	17.44	19.03	20.67	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3												0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	188.88	166.53	175.01	157.04	154.01	137.79	132.49	145.16	144.84	162.84	171.98	184.39	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	188.88	166.53	175.01	157.04	154.01	137.79	132.49	145.16	144.84	162.84	171.98	184.39	
Output from water heater (annual)$_{1...12}$												1920.94	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.58	75.04	79.97	73.3	72.99	66.89	65.84	70.05	69.24	75.93	78.26	83.09	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.51	15.55	12.65	9.57	7.16	6.04	6.53	8.49	11.39	14.46	16.88	18	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	195.99	198.02	192.9	181.98	168.21	155.27	146.62	144.59	149.71	160.62	174.4	187.34	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	(71)

Water heating gains (Table 5)

(72)m=	113.69	111.67	107.49	101.8	98.11	92.91	88.49	94.15	96.16	102.05	108.7	111.68	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	386.67	384.73	372.52	352.85	332.97	313.71	301.13	306.71	316.75	336.62	359.46	376.5	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)

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East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
South	0.9x	0.77	x	1.84	x	46.75	x	0.63	x	0.7	=	26.29	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.63	x	0.7	=	65.72	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.63	x	0.7	=	43.06	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.63	x	0.7	=	107.64	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.63	x	0.7	=	54.85	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.63	x	0.7	=	137.12	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.63	x	0.7	=	61.99	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.63	x	0.7	=	154.97	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.63	x	0.7	=	64.6	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.63	x	0.7	=	161.49	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.63	x	0.7	=	62.16	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.63	x	0.7	=	155.41	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.63	x	0.7	=	60.74	(78)

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South	0.9x	0.77	x	4.6	x	108.01	x	0.63	x	0.7	=	151.85	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.63	x	0.7	=	58.99	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.63	x	0.7	=	147.46	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.63	x	0.7	=	57.29	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.63	x	0.7	=	143.23	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.63	x	0.7	=	46.44	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.63	x	0.7	=	116.1	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.63	x	0.7	=	31.16	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.63	x	0.7	=	77.91	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.63	x	0.7	=	22.72	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.63	x	0.7	=	56.79	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	164.58	280.1	380.97	465.61	513.76	506.12	489.63	454.64	410.61	309.11	197.13	140.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	551.25	664.83	753.49	818.46	846.73	819.83	790.75	761.36	727.36	645.73	556.59	517.34	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.86	0.72	0.53	0.38	0.42	0.64	0.89	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.32	20.56	20.8	20.94	20.99	21	21	20.98	20.79	20.4	20.07	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.06	20.06	20.07	20.08	20.08	20.09	20.09	20.09	20.08	20.08	20.07	20.07	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.83	0.66	0.46	0.31	0.33	0.56	0.86	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.89	19.19	19.54	19.86	20.03	20.08	20.08	20.09	20.07	19.86	19.32	18.84	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.38	19.64	19.95	20.24	20.39	20.44	20.45	20.45	20.43	20.23	19.75	19.33	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.38	19.64	19.95	20.24	20.39	20.44	20.45	20.45	20.43	20.23	19.75	19.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.93	0.84	0.68	0.49	0.34	0.37	0.59	0.87	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	544.38	644.05	698.77	683.84	577.84	401.01	266.37	279.5	429.52	559.1	540.57	512.53	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1074.32	1047.62	953.4	794.97	608.16	404.88	266.75	280.12	440.23	673.83	889.18	1067.9	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	394.27	271.2	189.44	80.01	22.56	0	0	0	0	85.36	251	413.19

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1707.03 (98)

Space heating requirement in kWh/m²/year 24.58 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	394.27	271.2	189.44	80.01	22.56	0	0	0	0	85.36	251	413.19	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	421.68	290.05	202.61	85.57	24.12	0	0	0	0	91.3	268.45	441.91	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1825.7 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

188.88	166.53	175.01	157.04	154.01	137.79	132.49	145.16	144.84	162.84	171.98	184.39

Efficiency of water heater 79.8 (216)

(217)m=	86.73	86.11	85.03	83.12	81.02	79.8	79.8	79.8	79.8	83.18	85.82	86.9	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	217.77	193.39	205.83	188.94	190.09	172.67	166.03	181.91	181.5	195.76	200.39	212.17

Total = Sum(219a)$_{1...12}$ = 2306.43 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1825.7
Water heating fuel used		2306.43
Electricity for pumps, fans and electric keep-hot		

central heating pump:		30	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		309.22	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	394.35	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	498.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =			892.54	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	160.49	(268)
Total CO2, kg/year		sum of (265)…(271) =		1091.95	(272)

TER = 15.73 (273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-6-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.53	(1a) x	2.4	(2a) =	171.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.53	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.67	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	38.18	16.1	22.08	x	0.18	=	3.97			(29)
Walls Type2	15.79	2.1	13.69	x	0.18	=	2.46			(29)
Total area of elements, m²			53.97							(31)
Party wall			38.51	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 27.39 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.31 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 37.7 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	66.03	66.03	66.03	66.03	66.03	66.03	66.03	66.03	66.03	66.03	66.03	66.03	

Average = Sum(39)$_{1…12}$ /12= 66.03 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92

Average = Sum(40)$_{1\ldots12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.28 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.41 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	97.26	93.72	90.18	86.65	83.11	79.57	79.57	83.11	86.65	90.18	93.72	97.26	
											Total = Sum(44)$_{1\ldots12}$ =	1060.97	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	144.23	126.14	130.17	113.48	108.89	93.96	87.07	99.91	101.11	117.83	128.62	139.68	
											Total = Sum(45)$_{1\ldots12}$ =	1391.09	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	21.63	18.92	19.53	17.02	16.33	14.09	13.06	14.99	15.17	17.67	19.29	20.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.5	176.07	185.44	166.98	164.17	147.46	142.35	155.19	154.6	173.11	182.12	194.95	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.5	176.07	185.44	166.98	164.17	147.46	142.35	155.19	154.6	173.11	182.12	194.95	

Output from water heater (annual)$_{1...12}$ 2041.93 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.18	81.88	87.5	80.53	80.43	74.04	73.17	77.44	76.41	83.4	85.56	90.66	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.91	15.9	12.93	9.79	7.32	6.18	6.68	8.68	11.65	14.79	17.26	18.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.84	202.93	197.67	186.49	172.38	159.11	150.25	148.17	153.42	164.6	178.71	191.98	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	(71)

Water heating gains (Table 5)

(72)m=	123.89	121.85	117.61	111.84	108.1	102.83	98.35	104.09	106.13	112.1	118.84	121.86	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	399.88	397.92	385.46	365.37	345.04	325.36	312.52	318.18	328.44	348.73	372.05	389.48	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	5.29	x	46.75	x	0.5	x	0.8	=	68.56	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	5.29	x	76.57	x	0.5	x	0.8	=	112.28	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	5.29	x	97.53	x	0.5	x	0.8	=	143.02	(78)

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South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	5.29	x	110.23	x	0.5	x	0.8	=	161.65	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	5.29	x	114.87	x	0.5	x	0.8	=	168.45	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	5.29	x	110.55	x	0.5	x	0.8	=	162.11	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	5.29	x	108.01	x	0.5	x	0.8	=	158.39	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	5.29	x	104.89	x	0.5	x	0.8	=	153.82	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	5.29	x	101.89	x	0.5	x	0.8	=	149.4	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	5.29	x	82.59	x	0.5	x	0.8	=	121.1	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	5.29	x	55.42	x	0.5	x	0.8	=	81.26	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	5.29	x	40.4	x	0.5	x	0.8	=	59.24	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)

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West	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	148.15	256.59	358.83	451.9	508.69	505.02	486.97	445.33	391.57	286.02	178.31	126.19	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	548.03	654.51	744.29	817.27	853.73	830.38	799.49	763.51	720	634.75	550.36	515.67	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.85	0.69	0.5	0.36	0.4	0.62	0.89	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.42	20.65	20.85	20.96	21	21	21	20.98	20.83	20.48	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.81	0.63	0.44	0.29	0.32	0.55	0.85	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.14	19.41	19.72	19.99	20.12	20.14	20.15	20.15	20.14	19.97	19.5	19.06	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.58	19.81	20.09	20.34	20.46	20.48	20.49	20.49	20.48	20.32	19.89	19.51	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.58	19.81	20.09	20.34	20.46	20.48	20.49	20.49	20.48	20.32	19.89	19.51	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.82	0.65	0.47	0.32	0.35	0.57	0.86	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	541.56	634.56	687.92	671.34	558.98	386.42	256.56	269.6	413.93	547.13	535.01	511.23	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1008.68	984.59	897.48	755.15	578.11	388.58	256.74	269.93	421.02	641.51	844.53	1010.96	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	347.53	235.22	155.92	60.34	14.23	0	0	0	0	70.22	222.85	371.8	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 1478.12 (98)

Space heating requirement in kWh/m²/year 20.66 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1478.12	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1164.02	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	388.01	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		2041.93	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1608.02	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	536.01	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	36.96	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.29	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	46.29	(331)
Energy for lighting (calculated in Appendix L)		316.21	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit	32	(361)
Heat efficiency of CHP unit	38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	3063.21	x	0.22	661.65	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	980.23	x	0.52	-508.74	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4231.64	x	0.22	914.03	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1354.12	x	0.52	-702.79	(366)

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Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	214.61	(368)
Electrical energy for heat distribution	[(313) x	0.52	=	19.18	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	597.95	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			597.95	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	24.02	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	164.11	(379)
Total CO2, kg/year	sum of (376)…(382) =			786.09	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			10.99	(384)
EI rating (section 14)				90.96	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-6-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.53	(1a) x	2.4	(2a) =	171.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.53	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.67	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.19	x1/[1/(1.4)+ 0.04]		=	6.88			(27)
Windows Type 2			2.71	x1/[1/(1.4)+ 0.04]		=	3.59			(27)
Windows Type 3			5.19	x1/[1/(1.4)+ 0.04]		=	6.88			(27)
Windows Type 4			2.71	x1/[1/(1.4)+ 0.04]		=	3.59			(27)
Walls Type1	38.18	15.8	22.38	x	0.18	=	4.03			(29)
Walls Type2	15.79	2.1	13.69	x	0.18	=	2.46			(29)
Total area of elements, m²			53.97							(31)
Party wall			38.51	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	29.54	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		5.11	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	34.65	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.33	34.1	33.87	32.79	32.59	31.66	31.66	31.49	32.02	32.59	33	33.42	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	68.98	68.74	68.52	67.44	67.24	66.31	66.31	66.13	66.67	67.24	67.65	68.07	

Average = Sum(39)$_{1…12}$ /12= 67.44 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.96	0.96	0.96	0.94	0.94	0.93	0.93	0.92	0.93	0.94	0.95	0.95

Average = Sum(40)$_{1…12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.28 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.41 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	97.26	93.72	90.18	86.65	83.11	79.57	79.57	83.11	86.65	90.18	93.72	97.26	
										Total = Sum(44)$_{1…12}$ =		1060.97	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	144.23	126.14	130.17	113.48	108.89	93.96	87.07	99.91	101.11	117.83	128.62	139.68	
										Total = Sum(45)$_{1…12}$ =		1391.09	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	21.63	18.92	19.53	17.02	16.33	14.09	13.06	14.99	15.17	17.67	19.29	20.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	190.82	168.23	176.76	158.57	155.48	139.06	133.67	146.51	146.2	164.43	173.71	186.27	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	190.82	168.23	176.76	158.57	155.48	139.06	133.67	146.51	146.2	164.43	173.71	186.27	

Output from water heater (annual)$_{1...12}$ 1939.71 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.23	75.61	80.56	73.81	73.48	67.32	66.23	70.5	69.69	76.46	78.84	83.72	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.91	15.91	12.94	9.79	7.32	6.18	6.68	8.68	11.65	14.79	17.27	18.41	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.84	202.93	197.67	186.49	172.38	159.11	150.25	148.17	153.42	164.6	178.71	191.98	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	(71)

Water heating gains (Table 5)

(72)m=	114.56	112.52	108.27	102.51	98.77	93.49	89.01	94.75	96.79	102.76	109.5	112.52	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	393.55	391.59	379.12	359.04	338.71	319.03	306.19	311.84	322.11	342.4	365.72	383.15	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	5.19	x	46.75	x	0.63	x	0.7	=	74.15	(78)
South	0.9x	0.77	x	2.71	x	46.75	x	0.63	x	0.7	=	38.72	(78)
South	0.9x	0.77	x	5.19	x	76.57	x	0.63	x	0.7	=	121.45	(78)
South	0.9x	0.77	x	2.71	x	76.57	x	0.63	x	0.7	=	63.41	(78)
South	0.9x	0.77	x	5.19	x	97.53	x	0.63	x	0.7	=	154.7	(78)

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South	0.9x	0.77	x	2.71	x	97.53	x	0.63	x	0.7	=	80.78	(78)
South	0.9x	0.77	x	5.19	x	110.23	x	0.63	x	0.7	=	174.85	(78)
South	0.9x	0.77	x	2.71	x	110.23	x	0.63	x	0.7	=	91.3	(78)
South	0.9x	0.77	x	5.19	x	114.87	x	0.63	x	0.7	=	182.2	(78)
South	0.9x	0.77	x	2.71	x	114.87	x	0.63	x	0.7	=	95.14	(78)
South	0.9x	0.77	x	5.19	x	110.55	x	0.63	x	0.7	=	175.34	(78)
South	0.9x	0.77	x	2.71	x	110.55	x	0.63	x	0.7	=	91.56	(78)
South	0.9x	0.77	x	5.19	x	108.01	x	0.63	x	0.7	=	171.32	(78)
South	0.9x	0.77	x	2.71	x	108.01	x	0.63	x	0.7	=	89.46	(78)
South	0.9x	0.77	x	5.19	x	104.89	x	0.63	x	0.7	=	166.38	(78)
South	0.9x	0.77	x	2.71	x	104.89	x	0.63	x	0.7	=	86.87	(78)
South	0.9x	0.77	x	5.19	x	101.89	x	0.63	x	0.7	=	161.6	(78)
South	0.9x	0.77	x	2.71	x	101.89	x	0.63	x	0.7	=	84.38	(78)
South	0.9x	0.77	x	5.19	x	82.59	x	0.63	x	0.7	=	130.99	(78)
South	0.9x	0.77	x	2.71	x	82.59	x	0.63	x	0.7	=	68.4	(78)
South	0.9x	0.77	x	5.19	x	55.42	x	0.63	x	0.7	=	87.9	(78)
South	0.9x	0.77	x	2.71	x	55.42	x	0.63	x	0.7	=	45.9	(78)
South	0.9x	0.77	x	5.19	x	40.4	x	0.63	x	0.7	=	64.08	(78)
South	0.9x	0.77	x	2.71	x	40.4	x	0.63	x	0.7	=	33.46	(78)
West	0.9x	0.77	x	5.19	x	19.64	x	0.63	x	0.7	=	31.15	(80)
West	0.9x	0.77	x	2.71	x	19.64	x	0.63	x	0.7	=	16.27	(80)
West	0.9x	0.77	x	5.19	x	38.42	x	0.63	x	0.7	=	60.94	(80)
West	0.9x	0.77	x	2.71	x	38.42	x	0.63	x	0.7	=	31.82	(80)
West	0.9x	0.77	x	5.19	x	63.27	x	0.63	x	0.7	=	100.36	(80)
West	0.9x	0.77	x	2.71	x	63.27	x	0.63	x	0.7	=	52.4	(80)
West	0.9x	0.77	x	5.19	x	92.28	x	0.63	x	0.7	=	146.37	(80)
West	0.9x	0.77	x	2.71	x	92.28	x	0.63	x	0.7	=	76.43	(80)
West	0.9x	0.77	x	5.19	x	113.09	x	0.63	x	0.7	=	179.38	(80)
West	0.9x	0.77	x	2.71	x	113.09	x	0.63	x	0.7	=	93.66	(80)
West	0.9x	0.77	x	5.19	x	115.77	x	0.63	x	0.7	=	183.63	(80)
West	0.9x	0.77	x	2.71	x	115.77	x	0.63	x	0.7	=	95.88	(80)
West	0.9x	0.77	x	5.19	x	110.22	x	0.63	x	0.7	=	174.82	(80)
West	0.9x	0.77	x	2.71	x	110.22	x	0.63	x	0.7	=	91.28	(80)
West	0.9x	0.77	x	5.19	x	94.68	x	0.63	x	0.7	=	150.17	(80)
West	0.9x	0.77	x	2.71	x	94.68	x	0.63	x	0.7	=	78.41	(80)
West	0.9x	0.77	x	5.19	x	73.59	x	0.63	x	0.7	=	116.72	(80)
West	0.9x	0.77	x	2.71	x	73.59	x	0.63	x	0.7	=	60.95	(80)
West	0.9x	0.77	x	5.19	x	45.59	x	0.63	x	0.7	=	72.31	(80)
West	0.9x	0.77	x	2.71	x	45.59	x	0.63	x	0.7	=	37.76	(80)
West	0.9x	0.77	x	5.19	x	24.49	x	0.63	x	0.7	=	38.84	(80)
West	0.9x	0.77	x	2.71	x	24.49	x	0.63	x	0.7	=	20.28	(80)

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West	0.9x	0.77	x	5.19	x	16.15	x	0.63	x	0.7	=	25.62	(80)
West	0.9x	0.77	x	2.71	x	16.15	x	0.63	x	0.7	=	13.38	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	160.29	277.62	388.24	488.94	550.38	546.41	526.88	481.83	423.66	309.46	192.92	136.53	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	553.84	669.21	767.37	847.98	889.09	865.44	833.07	793.68	745.76	651.86	558.64	519.68	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.84	0.67	0.49	0.35	0.38	0.6	0.88	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.39	20.63	20.86	20.97	21	21	21	20.99	20.83	20.46	20.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.12	20.12	20.13	20.13	20.14	20.14	20.15	20.14	20.13	20.13	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.8	0.62	0.42	0.28	0.31	0.53	0.85	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.03	19.33	19.67	19.98	20.1	20.14	20.14	20.15	20.13	19.96	19.46	18.99	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.75	20.05	20.33	20.45	20.48	20.49	20.49	20.47	20.31	19.86	19.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.75	20.05	20.33	20.45	20.48	20.49	20.49	20.47	20.31	19.86	19.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.81	0.64	0.45	0.31	0.34	0.56	0.86	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	547.3	648.28	707.24	688.15	569.98	388.31	257.54	270.04	418.37	558.1	542.69	515.16	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1047.96	1020.9	928.65	770.83	588.25	390.12	257.7	270.32	424.86	652.73	863.12	1038.3	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	372.49	250.4	164.73	59.53	13.59	0	0	0	0	70.41	230.71	389.22	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 1551.08 (98)

Space heating requirement in kWh/m²/year 21.68 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	372.49	250.4	164.73	59.53	13.59	0	0	0	0	70.41	230.71	389.22		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	398.39	267.81	176.18	63.67	14.54	0	0	0	0	75.3	246.75	416.28		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1658.91	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	190.82	168.23	176.76	158.57	155.48	139.06	133.67	146.51	146.2	164.43	173.71	186.27		
Efficiency of water heater													79.8	(216)
(217)m=	86.57	85.87	84.63	82.46	80.57	79.8	79.8	79.8	79.8	82.73	85.57	86.74		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	220.43	195.9	208.87	192.3	192.99	174.25	167.5	183.6	183.21	198.74	203	214.76		
Total = Sum(219a)$_{1...12}$ =													2335.56	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1658.91	
Water heating fuel used			2335.56	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			316.28	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	358.32	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	504.48	(264)
Space and water heating	(261) + (262) + (263) + (264) =				862.81	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	164.15	(268)

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Total CO2, kg/year	sum of (265)…(271) =	1065.88	(272)
TER =		14.9	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-6-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.7	(1a) x	2.4	(2a) =	121.68	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.7	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.68	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	16.08	6.44	9.64	x	0.18	=	1.74			(29)
Walls Type2	13.61	2.1	11.51	x	0.18	=	2.07			(29)
Total area of elements, m²			29.69							(31)
Party wall			43.39	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 13.7 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.78 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 20.49 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	40.56	40.56	40.56	40.56	40.56	40.56	40.56	40.56	40.56	40.56	40.56	40.56

Average = Sum(39)$_{1…12}$ /12= 40.56 (39)

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Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8		

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 74.83 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.31	79.32	76.33	73.33	70.34	67.35	67.35	70.34	73.33	76.33	79.32	82.31	
Total = Sum(44)$_{1...12}$ =												897.96	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22	
Total = Sum(45)$_{1...12}$ =												1177.36	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.31	16.01	16.53	14.41	13.82	11.93	11.05	12.68	12.84	14.96	16.33	17.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = — 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1.03 (52)

Temperature factor from Table 2b — 0.6 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = — 1.03 (54)

Enter (50) or (54) in (55) — 1.03 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	177.34	156.69	165.44	149.54	147.44	133.02	128.97	139.84	139.07	155	162.35	173.49	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	177.34	156.69	165.44	149.54	147.44	133.02	128.97	139.84	139.07	155	162.35	173.49

Output from water heater (annual)$_{1...12}$ 1828.2 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.81	75.44	80.85	74.73	74.86	69.24	68.72	72.34	71.25	77.38	78.99	83.53	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	14.14	12.56	10.22	7.73	5.78	4.88	5.27	6.86	9.2	11.68	13.64	14.54	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	149.05	150.6	146.7	138.4	127.93	118.08	111.51	109.96	113.86	122.16	132.63	142.48	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	(71)
Water heating gains (Table 5)													
(72)m=	113.99	112.26	108.67	103.79	100.62	96.16	92.37	97.23	98.96	104.01	109.71	112.27	(72)
Total internal gains =						(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m							
(73)m=	325.85	324.08	314.25	298.59	283	267.79	257.82	262.71	270.68	286.51	304.64	317.94	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)

West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	35.06	68.59	112.95	164.74	201.89	206.67	196.76	169.01	131.37	81.38	43.72	28.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	360.91	392.67	427.2	463.33	484.89	474.46	454.57	431.72	402.05	367.89	348.36	346.78	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.9	0.74	0.54	0.39	0.43	0.68	0.92	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.37	20.47	20.65	20.85	20.96	21	21	21	20.98	20.84	20.56	20.33	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.87	0.69	0.48	0.33	0.36	0.61	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.42	19.57	19.82	20.09	20.22	20.25	20.25	20.25	20.24	20.07	19.7	19.36	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.89	20.02	20.24	20.47	20.59	20.62	20.63	20.63	20.61	20.46	20.13	19.85	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.89	20.02	20.24	20.47	20.59	20.62	20.63	20.63	20.61	20.46	20.13	19.85	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.88	0.72	0.51	0.36	0.4	0.64	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	357.42	385.6	408.4	406.34	346.95	243.01	163.22	171.23	258.75	332.87	341.06	344.15	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	632.46	613.36	557.2	469.21	360.73	244.33	163.32	171.43	264.21	399.79	528.54	634.79	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	204.63	153.05	110.7	45.27	10.26	0	0	0	0	49.79	134.98	216.24	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 924.92 (98)

Space heating requirement in kWh/m²/year 18.24 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating	**kWh/year**
Annual space heating requirement	924.92

DER WorkSheet: New dwelling design stage

Space heat from Community CHP	(98) x (304a) x (305) x (306) =	728.38	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	242.79	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1828.2	
If DHW from community scheme:			
Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1439.71	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	479.9	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	28.91	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		32.81	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	32.81	(331)
Energy for lighting (calculated in Appendix L)		249.8	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	1916.78	x	0.22		414.02	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	613.37	x	0.52		-318.34	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	3788.71	x	0.22		818.36	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1212.39	x	0.52		-629.23	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	167.85	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	15	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	467.67	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					467.67	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	17.03	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	129.64	(379)
Total CO2, kg/year	sum of (376)…(382) =					614.35	(383)

DER WorkSheet: New dwelling design stage

Dwelling CO2 Emission Rate	(383) ÷ (4) =	12.12	(384)
EI rating (section 14)		91.4	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-6-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.7	(1a) x	2.4	(2a) =	121.68	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.7	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.68	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

TER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Walls Type1	16.08	6.44	9.64	x	0.18	=	1.74			(29)
Walls Type2	13.61	2.1	11.51	x	0.18	=	2.07			(29)
Total area of elements, m²			29.69							(31)
Party wall			43.39	x	0	=	0			(32)

* *for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

** *include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	14.44	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		2.97	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	17.42	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	24.13	23.97	23.81	23.09	22.96	22.32	22.32	22.21	22.57	22.96	23.23	23.52	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	41.55	41.39	41.23	40.51	40.38	39.74	39.74	39.63	39.99	40.38	40.65	40.94	

Average = Sum(39)$_{1…12}$ /12= 40.51 (39)

TER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.81	0.8	0.8	0.78	0.78	0.78	0.79	0.8	0.8	0.81

Average = Sum(40)$_{1…12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 74.83 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	82.31	79.32	76.33	73.33	70.34	67.35	67.35	70.34	73.33	76.33	79.32	82.31

Total = Sum(44)$_{1…12}$ = 897.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22

Total = Sum(45)$_{1…12}$ = 1177.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.31	16.01	16.53	14.41	13.82	11.93	11.05	12.68	12.84	14.96	16.33	17.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): — 1.39 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) — 0.75 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.66	148.85	156.76	141.14	138.75	124.62	120.29	131.16	130.67	146.32	153.95	164.81	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.66	148.85	156.76	141.14	138.75	124.62	120.29	131.16	130.67	146.32	153.95	164.81	

Output from water heater (annual)$_{1...12}$ 1725.98 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.86	69.17	73.91	68.01	67.92	62.52	61.78	65.39	64.53	70.44	72.27	76.58	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.56	12.94	10.52	7.96	5.95	5.03	5.43	7.06	9.48	12.03	14.04	14.97	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	149.05	150.6	146.7	138.4	127.93	118.08	111.51	109.96	113.86	122.16	132.63	142.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	(71)

Water heating gains (Table 5)

(72)m=	104.65	102.93	99.34	94.46	91.29	86.83	83.04	87.89	89.62	94.67	100.37	102.93	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	319.93	318.12	308.22	292.49	276.83	261.6	251.64	256.58	264.62	280.52	298.71	312.04	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)

West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	38.65	75.62	124.53	181.62	222.58	227.85	216.93	186.34	144.83	89.73	48.2	31.79	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	358.59	393.74	432.75	474.11	499.42	489.45	468.56	442.91	409.45	370.25	346.91	343.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.89	0.72	0.52	0.37	0.41	0.66	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.33	20.45	20.64	20.86	20.97	21	21	21	20.99	20.84	20.56	20.32	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.25	20.26	20.27	20.27	20.27	20.26	20.26	20.25	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.86	0.67	0.46	0.31	0.35	0.59	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.35	19.52	19.8	20.1	20.23	20.27	20.27	20.27	20.25	20.09	19.69	19.33	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.84	19.99	20.22	20.48	20.6	20.63	20.63	20.63	20.62	20.46	20.12	19.83	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.84	19.99	20.22	20.48	20.6	20.63	20.63	20.63	20.62	20.46	20.12	19.83	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.87	0.7	0.49	0.34	0.38	0.63	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	355.36	386.83	413.37	411.08	347.76	238.83	160.25	167.67	256.36	333.77	339.82	341.38	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	645.77	624.49	565.81	469.14	359.34	239.72	160.31	167.8	260.76	398.26	529.4	639.66	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	216.06	159.71	113.42	41.8	8.62	0	0	0	0	47.98	136.5	221.93	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 946.02 (98)

Space heating requirement in kWh/m²/year 18.66 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	216.06	159.71	113.42	41.8	8.62	0	0	0	0	47.98	136.5	221.93	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	231.08	170.81	121.31	44.71	9.22	0	0	0	0	51.31	145.99	237.36	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1011.78 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

TER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

168.66	148.85	156.76	141.14	138.75	124.62	120.29	131.16	130.67	146.32	153.95	164.81

Efficiency of water heater 79.8 (216)

(217)m=	85.48	85	83.97	82.02	80.36	79.8	79.8	79.8	79.8	82.2	84.49	85.61	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	197.32	175.11	186.69	172.09	172.67	156.16	150.74	164.36	163.74	178.01	182.2	192.52

Total = Sum(219a)$_{1...12}$ = 2091.62 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1011.78	
Water heating fuel used		2091.62	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		257.21	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	218.54	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	451.79	(264)
Space and water heating	(261) + (262) + (263) + (264) =			670.33	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	133.49	(268)
Total CO2, kg/year		sum of (265)…(271) =		842.75	(272)

TER = 16.62 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-6-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.03	(1a) x	2.4	(2a) =	170.47	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.03	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.47	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 2			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	25.33	9.2	16.13	x	0.18	=	2.9			(29)
Walls Type2	13.71	2.1	11.61	x	0.18	=	2.09			(29)
Total area of elements, m²			39.04							(31)
Party wall			52.54	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 18.05 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.37 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 30.42 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	58.55	58.55	58.55	58.55	58.55	58.55	58.55	58.55	58.55	58.55	58.55	58.55	

Average = Sum(39)$_{1…12}$ /12= 58.55 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82

Average = Sum(40)$_{1...12}$ /12= 0.82 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.27 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	96.95	93.42	89.9	86.37	82.85	79.32	79.32	82.85	86.37	89.9	93.42	96.95	
										Total = Sum(44)$_{1...12}$ =		1057.6	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	143.77	125.74	129.75	113.12	108.54	93.66	86.79	99.6	100.79	117.46	128.21	139.23	
										Total = Sum(45)$_{1...12}$ =		1386.68	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	21.57	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.88	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)
If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H													
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

DER WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.05	175.67	185.03	166.62	163.82	147.16	142.07	154.87	154.28	172.73	181.71	194.51	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.05	175.67	185.03	166.62	163.82	147.16	142.07	154.87	154.28	172.73	181.71	194.51	

Output from water heater (annual)$_{1...12}$ 2037.52 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.02	81.75	87.36	80.41	80.31	73.94	73.08	77.34	76.31	83.28	85.43	90.52	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	18.87	16.76	13.63	10.32	7.71	6.51	7.04	9.15	12.28	15.59	18.19	19.4	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	199.69	201.76	196.54	185.42	171.39	158.2	149.39	147.32	152.54	163.66	177.69	190.88	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	(71)
Water heating gains (Table 5)													
(72)m=	123.69	121.65	117.43	111.68	107.95	102.69	98.23	103.95	105.98	111.93	118.65	121.66	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	399.31	397.24	384.66	364.48	344.11	324.47	311.72	317.48	327.86	348.24	371.59	389	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)

West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	50.09	97.98	161.36	235.34	288.41	295.24	281.08	241.45	187.67	116.26	62.45	41.19	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	449.4	495.22	546.02	599.82	632.53	619.71	592.8	558.92	515.53	464.5	434.05	430.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.8	0.6	0.43	0.48	0.74	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.26	20.37	20.56	20.79	20.94	20.99	21	21	20.97	20.77	20.46	20.22	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.75	0.53	0.36	0.4	0.68	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.23	19.39	19.67	19.99	20.18	20.23	20.23	20.23	20.21	19.97	19.53	19.18	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.64	19.78	20.03	20.31	20.48	20.53	20.54	20.54	20.51	20.29	19.91	19.6	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.64	19.78	20.03	20.31	20.48	20.53	20.54	20.54	20.51	20.29	19.91	19.6	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.76	0.56	0.39	0.43	0.7	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	447.09	490.07	530.63	546.13	483.45	344.04	230.34	241.75	361.8	435.8	429.06	428.5	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	898.27	871.41	791.97	667.91	514.27	347.39	230.62	242.3	375.57	567.18	749.73	901.54	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	335.68	256.26	194.44	87.69	22.93	0	0	0	0	97.75	230.88	351.94	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1577.55 (98)

Space heating requirement in kWh/m²/year 22.21 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1577.55	

DER WorkSheet: New dwelling design stage

Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1242.32	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	414.11	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2037.52	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1604.54	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	534.85	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	37.96	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		45.96	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	45.96	(331)
Energy for lighting (calculated in Appendix L)		333.28	(332)

12b. CO_2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	3269.27	x	0.22		706.16	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1046.17	x	0.52		-542.96	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4222.49	x	0.22		912.06	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1351.2	x	0.52		-701.27	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	220.4	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	19.7	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	614.09	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					614.09	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	23.85	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	172.97	(379)
Total CO2, kg/year	sum of (376)…(382) =					810.92	(383)

DER WorkSheet: New dwelling design stage

Dwelling CO2 Emission Rate	(383) ÷ (4) =	11.42	(384)
EI rating (section 14)		90.63	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version: Version: 1.0.4.8

Property Address: b1-6-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.03	(1a) x	2.4	(2a) =	170.47	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.03	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.47	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.43	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 2			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	25.33	9.2	16.13	x	0.18	=	2.9			(29)
Walls Type2	13.71	2.1	11.61	x	0.18	=	2.09			(29)
Total area of elements, m²			39.04							(31)
Party wall			52.54	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.29 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.18 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 22.47 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.12	33.89	33.66	32.59	32.39	31.46	31.46	31.28	31.82	32.39	32.8	33.22	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	56.59	56.36	56.13	55.06	54.86	53.93	53.93	53.75	54.29	54.86	55.27	55.69	

Average = Sum(39)$_{1\ldots12}$ /12= 55.06 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.8	0.79	0.79	0.78	0.77	0.76	0.76	0.76	0.76	0.77	0.78	0.78

Average = Sum(40)$_{1…12}$ /12= 0.78 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.27 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.95	93.42	89.9	86.37	82.85	79.32	79.32	82.85	86.37	89.9	93.42	96.95

Total = Sum(44)$_{1…12}$ = 1057.6 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.77	125.74	129.75	113.12	108.54	93.66	86.79	99.6	100.79	117.46	128.21	139.23

Total = Sum(45)$_{1…12}$ = 1386.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.57	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.88

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	190.36	167.83	176.35	158.21	155.14	138.76	133.39	146.19	145.88	164.05	173.31	185.83	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	190.36	167.83	176.35	158.21	155.14	138.76	133.39	146.19	145.88	164.05	173.31	185.83	

Output from water heater (annual)$_{1...12}$ 1935.29 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.08	75.48	80.42	73.69	73.37	67.22	66.13	70.39	69.59	76.33	78.7	83.57	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.43	17.26	14.03	10.62	7.94	6.7	7.24	9.42	12.64	16.05	18.73	19.97	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.69	201.76	196.54	185.42	171.39	158.2	149.39	147.32	152.54	163.66	177.69	190.88	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	(71)

Water heating gains (Table 5)

(72)m=	114.35	112.32	108.09	102.34	98.61	93.36	88.89	94.61	96.65	102.59	109.31	112.33	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	393.53	391.4	378.73	358.45	338.01	318.33	305.59	311.41	321.89	342.36	365.8	383.24	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(80)

West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	55.22	108.02	177.9	259.46	317.98	325.5	309.89	266.19	206.91	128.18	68.85	45.41	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	448.76	499.42	556.63	617.91	655.98	643.83	615.48	577.61	528.8	470.54	434.65	428.65	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.9	0.74	0.53	0.39	0.43	0.69	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.3	20.42	20.62	20.85	20.97	21	21	21	20.99	20.82	20.52	20.28	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(88)m=	20.26	20.26	20.26	20.27	20.28	20.29	20.29	20.29	20.28	20.28	20.27	20.27		(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.7	0.48	0.32	0.36	0.63	0.92	0.99	1		(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.31	19.49	19.78	20.1	20.25	20.29	20.29	20.29	20.27	20.07	19.65	19.3		(90)
										fLA = Living area ÷ (4) =			0.4	(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.71	19.86	20.11	20.4	20.54	20.57	20.57	20.57	20.56	20.37	20	19.69		(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.71	19.86	20.11	20.4	20.54	20.57	20.57	20.57	20.56	20.37	20	19.69		(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.99	0.97	0.89	0.71	0.5	0.35	0.39	0.65	0.92	0.99	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	446.38	493.65	537.87	546.88	468	320.82	214.18	224.22	343.86	434.86	429.1	426.92		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	871.86	843.21	764.13	633.27	484.74	322	214.26	224.38	350.6	536.11	712.94	862.65		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	316.55	234.91	168.34	62.21	12.46	0	0	0	0	75.33	204.37	324.19		
									Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =				1398.35	(98)
Space heating requirement in kWh/m²/year													19.69	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	316.55	234.91	168.34	62.21	12.46	0	0	0	0	75.33	204.37	324.19		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	338.56	251.24	180.05	66.53	13.32	0	0	0	0	80.57	218.57	346.72		
									Total (kWh/year) =Sum(211)$_{1...5,10...12}$=				1495.56	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
									Total (kWh/year) =Sum(215)$_{1...5,10...12}$=				0	(215)

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Water heating

Output from water heater (calculated above)

190.36	167.83	176.35	158.21	155.14	138.76	133.39	146.19	145.88	164.05	173.31	185.83

Efficiency of water heater 79.8 (216)

(217)m=	86.16	85.71	84.69	82.55	80.51	79.8	79.8	79.8	79.8	82.88	85.25	86.28	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	220.94	195.81	208.23	191.65	192.7	173.88	167.15	183.2	182.81	197.93	203.28	215.37

Total = Sum(219a)$_{1...12}$ = 2332.94 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1495.56	
Water heating fuel used		2332.94	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		343.11	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	323.04	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	503.91	(264)
Space and water heating	(261) + (262) + (263) + (264) =				826.96	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	178.07	(268)
Total CO2, kg/year			sum of (265)…(271) =		1043.96	(272)

TER = 14.7 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-6-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.5	(1a) x	2.4	(2a) =	178.8	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	178.8	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 2			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	39.17	17.25	21.92	x	0.18	=	3.95			(29)
Walls Type2	5.47	2.1	3.37	x	0.18	=	0.61			(29)
Total area of elements, m²			44.64							(31)
Party wall			51.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 26.82 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.57 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 37.4 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9

Average = Sum(39)$_{1...12}$ /12= 66.9 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9

Average = Sum(40)$_{1...12}$ /12= 0.9 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.02 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	99.02	95.42	91.82	88.22	84.62	81.02	81.02	84.62	88.22	91.82	95.42	99.02

Total = Sum(44)$_{1...12}$ = 1080.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.84	128.43	132.53	115.54	110.87	95.67	88.65	101.73	102.94	119.97	130.96	142.21

Total = Sum(45)$_{1...12}$ = 1416.34 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.03	19.26	19.88	17.33	16.63	14.35	13.3	15.26	15.44	18	19.64	21.33	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.12	178.36	187.81	169.04	166.14	149.16	143.93	157	156.44	175.25	184.45	197.49	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.12	178.36	187.81	169.04	166.14	149.16	143.93	157	156.44	175.25	184.45	197.49	

Output from water heater (annual)$_{1...12}$	2067.18	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.05	82.65	88.29	81.21	81.08	74.6	73.7	78.05	77.02	84.11	86.34	91.51	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	18.5	16.44	13.37	10.12	7.56	6.39	6.9	8.97	12.04	15.29	17.84	19.02	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	207.56	209.72	204.29	192.74	178.15	164.44	155.28	153.13	158.56	170.11	184.7	198.41	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	(71)
Water heating gains (Table 5)													
(72)m=	125.06	122.98	118.67	112.8	108.98	103.62	99.06	104.9	106.98	113.05	119.91	122.99	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	409.39	407.39	394.58	373.9	352.95	332.7	319.49	325.25	335.83	356.7	380.71	398.67	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)

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North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)

West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	73.82	143.33	238.41	359.1	455.14	473.73	447.72	373.65	280.31	170.24	91.72	60.97	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	483.2	550.72	632.99	733.01	808.09	806.42	767.21	698.9	616.14	526.94	472.43	459.64	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.73	0.53	0.38	0.44	0.71	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.3	20.53	20.8	20.96	20.99	21	21	20.97	20.74	20.39	20.12	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.87	0.68	0.46	0.31	0.36	0.64	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.25	19.58	19.95	20.13	20.17	20.17	20.17	20.15	19.88	19.38	18.99	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.67	19.96	20.29	20.46	20.5	20.5	20.5	20.48	20.22	19.79	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.67	19.96	20.29	20.46	20.5	20.5	20.5	20.48	20.22	19.79	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.99	0.99	0.96	0.88	0.69	0.49	0.34	0.39	0.67	0.93	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	480.58	543.94	609.66	642.34	561.24	392.03	260.75	273.8	411.88	490.33	466.65	457.76	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1016.29	987.94	900.61	761.9	586.01	394.52	260.98	274.32	426.59	643.78	848.63	1019.62	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	398.57	298.37	216.47	86.08	18.42	0	0	0	0	114.16	275.03	418.02	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1825.12 (98)

Space heating requirement in kWh/m²/year 24.5 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1825.12	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1437.28	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	479.09	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		2067.18	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1627.9	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	542.63	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	40.87	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		48.21	(330a)

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warm air heating system fans					0	(330b)
pump for solar water heating					0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =				48.21	(331)
Energy for lighting (calculated in Appendix L)					326.8	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	3782.33	x	0.22		816.98	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1210.34	x	0.52		-628.17	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4283.95	x	0.22		925.33	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1370.87	x	0.52		-711.48	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	237.3	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	21.21	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)				=	661.18	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					661.18	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	25.02	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	169.61	(379)
Total CO2, kg/year	sum of (376)…(382) =					855.81	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					11.49	(384)
EI rating (section 14)						90.4	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-6-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.5	(1a) x	2.4	(2a) =	178.8	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	178.8	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.41	x1/[1/(1.4)+ 0.04]		=	5.85			(27)
Windows Type 2			5.07	x1/[1/(1.4)+ 0.04]		=	6.72			(27)
Windows Type 3			2.64	x1/[1/(1.4)+ 0.04]		=	3.5			(27)
Windows Type 4			2.64	x1/[1/(1.4)+ 0.04]		=	3.5			(27)
Windows Type 5			1.76	x1/[1/(1.4)+ 0.04]		=	2.33			(27)
Walls Type1	39.17	16.52	22.65	x	0.18	=	4.08			(29)
Walls Type2	5.47	2.1	3.37	x	0.18	=	0.61			(29)
Total area of elements, m²			44.64							(31)
Party wall			51.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	28.69	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		4.66	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	33.34	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	35.55	35.32	35.09	34	33.8	32.86	32.86	32.69	33.22	33.8	34.21	34.64	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	68.89	68.66	68.43	67.35	67.14	66.2	66.2	66.03	66.56	67.14	67.55	67.98

Average = Sum(39)$_{1...12}$ /12= 67.34 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.92	0.92	0.92	0.9	0.9	0.89	0.89	0.89	0.89	0.9	0.91	0.91

Average = Sum(40)$_{1...12}$ /12= 0.9 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.02 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	99.02	95.42	91.82	88.22	84.62	81.02	81.02	84.62	88.22	91.82	95.42	99.02

Total = Sum(44)$_{1...12}$ = 1080.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.84	128.43	132.53	115.54	110.87	95.67	88.65	101.73	102.94	119.97	130.96	142.21

Total = Sum(45)$_{1...12}$ = 1416.34 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.03	19.26	19.88	17.33	16.63	14.35	13.3	15.26	15.44	18	19.64	21.33	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	193.44	170.52	179.12	160.63	157.46	140.76	135.25	148.32	148.03	166.56	176.05	188.81	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	193.44	170.52	179.12	160.63	157.46	140.76	135.25	148.32	148.03	166.56	176.05	188.81	

Output from water heater (annual)1…12 | 1964.96 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.1	76.37	81.34	74.49	74.14	67.88	66.75	71.1	70.3	77.17	79.62	84.56	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	18.51	16.44	13.37	10.12	7.57	6.39	6.9	8.97	12.04	15.29	17.84	19.02	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	207.56	209.72	204.29	192.74	178.15	164.44	155.28	153.13	158.56	170.11	184.7	198.41	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	(71)
Water heating gains (Table 5)													
(72)m=	115.73	113.65	109.33	103.46	99.65	94.28	89.72	95.57	97.64	103.72	110.58	113.66	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	403.05	401.06	388.24	367.57	346.62	326.36	313.16	318.92	329.49	350.37	374.37	392.34	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.07	x	10.63	x	0.63	x	0.7	=	16.48	(74)
North	0.9x	0.77	x	2.64	x	10.63	x	0.63	x	0.7	=	8.58	(74)

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North	0.9x	0.77	x	5.07	x	20.32	x	0.63	x	0.7	=	31.49	(74)
North	0.9x	0.77	x	2.64	x	20.32	x	0.63	x	0.7	=	16.4	(74)
North	0.9x	0.77	x	5.07	x	34.53	x	0.63	x	0.7	=	53.5	(74)
North	0.9x	0.77	x	2.64	x	34.53	x	0.63	x	0.7	=	27.86	(74)
North	0.9x	0.77	x	5.07	x	55.46	x	0.63	x	0.7	=	85.94	(74)
North	0.9x	0.77	x	2.64	x	55.46	x	0.63	x	0.7	=	44.75	(74)
North	0.9x	0.77	x	5.07	x	74.72	x	0.63	x	0.7	=	115.77	(74)
North	0.9x	0.77	x	2.64	x	74.72	x	0.63	x	0.7	=	60.28	(74)
North	0.9x	0.77	x	5.07	x	79.99	x	0.63	x	0.7	=	123.93	(74)
North	0.9x	0.77	x	2.64	x	79.99	x	0.63	x	0.7	=	64.53	(74)
North	0.9x	0.77	x	5.07	x	74.68	x	0.63	x	0.7	=	115.71	(74)
North	0.9x	0.77	x	2.64	x	74.68	x	0.63	x	0.7	=	60.25	(74)
North	0.9x	0.77	x	5.07	x	59.25	x	0.63	x	0.7	=	91.8	(74)
North	0.9x	0.77	x	2.64	x	59.25	x	0.63	x	0.7	=	47.8	(74)
North	0.9x	0.77	x	5.07	x	41.52	x	0.63	x	0.7	=	64.33	(74)
North	0.9x	0.77	x	2.64	x	41.52	x	0.63	x	0.7	=	33.5	(74)
North	0.9x	0.77	x	5.07	x	24.19	x	0.63	x	0.7	=	37.48	(74)
North	0.9x	0.77	x	2.64	x	24.19	x	0.63	x	0.7	=	19.52	(74)
North	0.9x	0.77	x	5.07	x	13.12	x	0.63	x	0.7	=	20.33	(74)
North	0.9x	0.77	x	2.64	x	13.12	x	0.63	x	0.7	=	10.58	(74)
North	0.9x	0.77	x	5.07	x	8.86	x	0.63	x	0.7	=	13.74	(74)
North	0.9x	0.77	x	2.64	x	8.86	x	0.63	x	0.7	=	7.15	(74)
West	0.9x	0.77	x	4.41	x	19.64	x	0.63	x	0.7	=	26.47	(80)
West	0.9x	0.77	x	2.64	x	19.64	x	0.63	x	0.7	=	15.85	(80)
West	0.9x	0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(80)
West	0.9x	0.77	x	4.41	x	38.42	x	0.63	x	0.7	=	51.78	(80)
West	0.9x	0.77	x	2.64	x	38.42	x	0.63	x	0.7	=	31	(80)
West	0.9x	0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(80)
West	0.9x	0.77	x	4.41	x	63.27	x	0.63	x	0.7	=	85.28	(80)
West	0.9x	0.77	x	2.64	x	63.27	x	0.63	x	0.7	=	51.05	(80)
West	0.9x	0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(80)
West	0.9x	0.77	x	4.41	x	92.28	x	0.63	x	0.7	=	124.37	(80)
West	0.9x	0.77	x	2.64	x	92.28	x	0.63	x	0.7	=	74.45	(80)
West	0.9x	0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(80)
West	0.9x	0.77	x	4.41	x	113.09	x	0.63	x	0.7	=	152.42	(80)
West	0.9x	0.77	x	2.64	x	113.09	x	0.63	x	0.7	=	91.25	(80)
West	0.9x	0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(80)
West	0.9x	0.77	x	4.41	x	115.77	x	0.63	x	0.7	=	156.03	(80)
West	0.9x	0.77	x	2.64	x	115.77	x	0.63	x	0.7	=	93.41	(80)
West	0.9x	0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(80)
West	0.9x	0.77	x	4.41	x	110.22	x	0.63	x	0.7	=	148.55	(80)

West	0.9x	0.77	x	2.64	x	110.22	x	0.63	x	0.7	=	88.93	(80)
West	0.9x	0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(80)
West	0.9x	0.77	x	4.41	x	94.68	x	0.63	x	0.7	=	127.6	(80)
West	0.9x	0.77	x	2.64	x	94.68	x	0.63	x	0.7	=	76.39	(80)
West	0.9x	0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(80)
West	0.9x	0.77	x	4.41	x	73.59	x	0.63	x	0.7	=	99.18	(80)
West	0.9x	0.77	x	2.64	x	73.59	x	0.63	x	0.7	=	59.37	(80)
West	0.9x	0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(80)
West	0.9x	0.77	x	4.41	x	45.59	x	0.63	x	0.7	=	61.44	(80)
West	0.9x	0.77	x	2.64	x	45.59	x	0.63	x	0.7	=	36.78	(80)
West	0.9x	0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(80)
West	0.9x	0.77	x	4.41	x	24.49	x	0.63	x	0.7	=	33.01	(80)
West	0.9x	0.77	x	2.64	x	24.49	x	0.63	x	0.7	=	19.76	(80)
West	0.9x	0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(80)
West	0.9x	0.77	x	4.41	x	16.15	x	0.63	x	0.7	=	21.77	(80)
West	0.9x	0.77	x	2.64	x	16.15	x	0.63	x	0.7	=	13.03	(80)
West	0.9x	0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	77.94	151.33	251.72	379.15	480.55	500.17	472.72	394.51	295.96	179.74	96.84	64.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	480.99	552.38	639.96	746.72	827.16	826.54	785.87	713.43	625.45	530.11	471.22	456.71	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.89	0.72	0.51	0.37	0.42	0.7	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.12	20.27	20.51	20.81	20.96	21	21	21	20.97	20.74	20.38	20.1	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.16	20.17	20.18	20.18	20.18	20.17	20.17	20.16	20.16	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.87	0.66	0.45	0.3	0.35	0.63	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.19	19.54	19.95	20.13	20.17	20.18	20.18	20.15	19.88	19.36	18.94	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.43	19.62	19.93	20.29	20.46	20.5	20.51	20.51	20.48	20.22	19.77	19.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.43	19.62	19.93	20.29	20.46	20.5	20.51	20.51	20.48	20.22	19.77	19.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.87	0.68	0.47	0.33	0.38	0.66	0.93	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	478.49	545.7	616.28	650.32	565.25	388.81	258.41	270.75	411.48	492.75	465.59	454.92	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1042.15	1010.51	919.05	767.15	588.25	390.79	258.58	271.16	424.77	646.06	855.64	1033.55	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	419.37	312.35	225.26	84.11	17.11	0	0	0	0	114.06	280.84	430.5

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1883.6 (98)

Space heating requirement in kWh/m²/year 25.28 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	419.37	312.35	225.26	84.11	17.11	0	0	0	0	114.06	280.84	430.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	448.52	334.06	240.92	89.96	18.3	0	0	0	0	121.99	300.36	460.43	(211)

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2014.55 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

193.44	170.52	179.12	160.63	157.46	140.76	135.25	148.32	148.03	166.56	176.05	188.81

Efficiency of water heater 79.8 (216)

(217)m=	86.83	86.41	85.43	83.18	80.74	79.8	79.8	79.8	79.8	83.83	86.05	86.95	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	222.79	197.34	209.68	193.12	195.03	176.39	169.48	185.87	185.51	198.7	204.58	217.15

Total = Sum(219a)$_{1...12}$ = 2355.64 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2014.55
Water heating fuel used		2355.64
Electricity for pumps, fans and electric keep-hot		

central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			326.83	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	435.14	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	508.82	(264)
Space and water heating	(261) + (262) + (263) + (264) =				943.96	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	169.63	(268)
Total CO2, kg/year			sum of (265)…(271) =		1152.51	(272)

TER = 15.47 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-8-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.18	(1a) x	2.4	(2a) =	170.83	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.18	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.83	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 2			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 4			8.05	x1/[1/(1.2)+ 0.04]		=	9.22			(27)
Walls Type1	39.96	17.02	22.94	x	0.18	=	4.13			(29)
Walls Type2	5.87	2.1	3.77	x	0.18	=	0.68			(29)
Roof	71.18	0	71.18	x	0.11	=	7.83			(30)
Total area of elements, m²			117.01							(31)
Party wall			39.46	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.65 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.05 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 48.7 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.88	76.88	76.88	76.88	76.88	76.88	76.88	76.88	76.88	76.88	76.88	76.88	

Average = $Sum(39)_{1...12}$ /12= 76.88 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	

Average = $Sum(40)_{1...12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.27 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	97.04	93.51	89.98	86.45	82.92	79.4	79.4	82.92	86.45	89.98	93.51	97.04	

Total = $Sum(44)_{1...12}$ = 1058.61 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.91	125.86	129.88	113.23	108.65	93.75	86.88	99.69	100.88	117.57	128.34	139.37	

Total = $Sum(45)_{1...12}$ = 1388.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.59	18.88	19.48	16.98	16.3	14.06	13.03	14.95	15.13	17.64	19.25	20.9	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.18	175.79	185.15	166.72	163.92	147.25	142.15	154.97	154.38	172.85	181.83	194.64	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.18	175.79	185.15	166.72	163.92	147.25	142.15	154.97	154.38	172.85	181.83	194.64

Output from water heater (annual)$_{1...12}$	2038.85	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.07	81.79	87.41	80.44	80.35	73.97	73.11	77.37	76.34	83.31	85.47	90.56	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.83	15.84	12.88	9.75	7.29	6.15	6.65	8.64	11.6	14.73	17.19	18.33	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.04	202.11	196.88	185.74	171.69	158.48	149.65	147.57	152.81	163.94	178	191.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	(71)

Water heating gains (Table 5)

(72)m=	123.75	121.71	117.48	111.73	107.99	102.73	98.26	103.99	106.03	111.98	118.7	121.72	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	398.74	396.78	384.36	364.34	344.09	324.48	311.68	317.33	327.55	347.77	371.01	388.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)

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North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
East	0.9x	1	x	8.05	x	19.64	x	0.5	x	0.8	=	43.83	(76)
East	0.9x	1	x	8.05	x	38.42	x	0.5	x	0.8	=	85.73	(76)
East	0.9x	1	x	8.05	x	63.27	x	0.5	x	0.8	=	141.19	(76)
East	0.9x	1	x	8.05	x	92.28	x	0.5	x	0.8	=	205.92	(76)
East	0.9x	1	x	8.05	x	113.09	x	0.5	x	0.8	=	252.36	(76)
East	0.9x	1	x	8.05	x	115.77	x	0.5	x	0.8	=	258.34	(76)
East	0.9x	1	x	8.05	x	110.22	x	0.5	x	0.8	=	245.95	(76)

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East	0.9x	1	x	8.05	x	94.68	x	0.5	x	0.8	=	211.27	(76)
East	0.9x	1	x	8.05	x	73.59	x	0.5	x	0.8	=	164.21	(76)
East	0.9x	1	x	8.05	x	45.59	x	0.5	x	0.8	=	101.73	(76)
East	0.9x	1	x	8.05	x	24.49	x	0.5	x	0.8	=	54.65	(76)
East	0.9x	1	x	8.05	x	16.15	x	0.5	x	0.8	=	36.04	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	70.27	136.26	227.05	343.83	438.14	457.22	431.63	358.58	267.44	161.88	87.26	58.08	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	469	533.04	611.41	708.17	782.23	781.7	743.31	675.91	594.99	509.65	458.28	446.46	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.8	0.61	0.45	0.51	0.79	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.91	20.05	20.31	20.64	20.88	20.98	21	20.99	20.92	20.59	20.18	19.87	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.75	0.52	0.35	0.41	0.71	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.57	18.78	19.15	19.6	19.91	20	20.02	20.01	19.95	19.55	18.96	18.51	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.1	19.29	19.61	20.02	20.3	20.39	20.41	20.41	20.34	19.96	19.45	19.05	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.1	19.29	19.61	20.02	20.3	20.39	20.41	20.41	20.34	19.96	19.45	19.05	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.76	0.56	0.39	0.45	0.74	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	466.45	527.16	593.54	643.39	596.57	435.29	291.47	305.3	439.61	482.57	453.18	444.55	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1138.1	1106.11	1008.22	854.72	660.97	445.38	292.76	307.95	479.77	719.82	949.44	1141.88	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	499.71	389.06	308.53	152.16	47.91	0	0	0	0	176.51	357.31	518.81	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 2450 (98)

Space heating requirement in kWh/m²/year 34.42 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.			
Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2450	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1929.38	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	643.13	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2038.85	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1605.59	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	535.2	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	47.13	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.06	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	46.06	(331)
Energy for lighting (calculated in Appendix L)		314.94	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	5077.31	x	0.22	1096.7	(363)

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less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1624.74	x	0.52		-843.24	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4225.24	x	0.22		912.65	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1352.08	x	0.52		-701.73	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	273.67	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	24.46	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	762.52	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					762.52	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	23.9	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	163.45	(379)
Total CO2, kg/year	sum of (376)…(382) =					949.88	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					13.34	(384)
EI rating (section 14)						89.04	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-8-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.18	(1a) x	2.4	(2a) =	170.83	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.18	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.83	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.43	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.7	x1/[1/(1.4)+ 0.04]		=	2.25			(27)
Windows Type 2			4.88	x1/[1/(1.4)+ 0.04]		=	6.47			(27)
Windows Type 3			1.7	x1/[1/(1.4)+ 0.04]		=	2.25			(27)
Windows Type 4			7.42	x1/[1/(1.4)+ 0.04]		=	9.84			(27)
Walls Type1	39.96	15.7	24.26	x	0.18	=	4.37			(29)
Walls Type2	5.87	2.1	3.77	x	0.18	=	0.68			(29)
Roof	71.18	0	71.18	x	0.13	=	9.25			(30)
Total area of elements, m²			117.01							(31)
Party wall			39.46	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.21 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.18 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 43.39 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(38)m=	34.18	33.95	33.72	32.65	32.45	31.52	31.52	31.34	31.88	32.45	32.86	33.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	77.57	77.34	77.11	76.04	75.84	74.91	74.91	74.73	75.27	75.84	76.25	76.67	

Average = Sum(39)1…12 /12= 76.04 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.09	1.09	1.08	1.07	1.07	1.05	1.05	1.05	1.06	1.07	1.07	1.08	

Average = Sum(40)1…12 /12= 1.07 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.27 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	97.04	93.51	89.98	86.45	82.92	79.4	79.4	82.92	86.45	89.98	93.51	97.04	

Total = Sum(44)1…12 = 1058.61 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.91	125.86	129.88	113.23	108.65	93.75	86.88	99.69	100.88	117.57	128.34	139.37	

Total = Sum(45)1…12 = 1388.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.59	18.88	19.48	16.98	16.3	14.06	13.03	14.95	15.13	17.64	19.25	20.9	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	190.5	167.95	176.47	158.32	155.24	138.85	133.47	146.29	145.98	164.17	173.43	185.96	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	190.5	167.95	176.47	158.32	155.24	138.85	133.47	146.29	145.98	164.17	173.43	185.96

Output from water heater (annual)$_{1...12}$ | 1936.62 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.12	75.52	80.46	73.72	73.4	67.25	66.16	70.42	69.62	76.37	78.75	83.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.84	15.84	12.88	9.75	7.29	6.16	6.65	8.65	11.6	14.74	17.2	18.33	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.04	202.11	196.88	185.74	171.69	158.48	149.65	147.57	152.81	163.94	178	191.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	(71)

Water heating gains (Table 5)

(72)m=	114.42	112.38	108.15	102.39	98.66	93.4	88.93	94.66	96.69	102.65	109.37	112.39	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	392.4	390.45	378.03	358.01	337.75	318.15	305.35	310.99	321.22	341.44	364.68	382.05	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.7	x	10.63	x	0.63	x	0.7	=	5.52	(74)
North	0.9x	0.77	x	4.88	x	10.63	x	0.63	x	0.7	=	15.86	(74)

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North	0.9x	0.77	x	1.7	x	10.63	x	0.63	x	0.7	=	5.52	(74)
North	0.9x	0.77	x	1.7	x	20.32	x	0.63	x	0.7	=	10.56	(74)
North	0.9x	0.77	x	4.88	x	20.32	x	0.63	x	0.7	=	30.31	(74)
North	0.9x	0.77	x	1.7	x	20.32	x	0.63	x	0.7	=	10.56	(74)
North	0.9x	0.77	x	1.7	x	34.53	x	0.63	x	0.7	=	17.94	(74)
North	0.9x	0.77	x	4.88	x	34.53	x	0.63	x	0.7	=	51.5	(74)
North	0.9x	0.77	x	1.7	x	34.53	x	0.63	x	0.7	=	17.94	(74)
North	0.9x	0.77	x	1.7	x	55.46	x	0.63	x	0.7	=	28.82	(74)
North	0.9x	0.77	x	4.88	x	55.46	x	0.63	x	0.7	=	82.72	(74)
North	0.9x	0.77	x	1.7	x	55.46	x	0.63	x	0.7	=	28.82	(74)
North	0.9x	0.77	x	1.7	x	74.72	x	0.63	x	0.7	=	38.82	(74)
North	0.9x	0.77	x	4.88	x	74.72	x	0.63	x	0.7	=	111.43	(74)
North	0.9x	0.77	x	1.7	x	74.72	x	0.63	x	0.7	=	38.82	(74)
North	0.9x	0.77	x	1.7	x	79.99	x	0.63	x	0.7	=	41.56	(74)
North	0.9x	0.77	x	4.88	x	79.99	x	0.63	x	0.7	=	119.29	(74)
North	0.9x	0.77	x	1.7	x	79.99	x	0.63	x	0.7	=	41.56	(74)
North	0.9x	0.77	x	1.7	x	74.68	x	0.63	x	0.7	=	38.8	(74)
North	0.9x	0.77	x	4.88	x	74.68	x	0.63	x	0.7	=	111.37	(74)
North	0.9x	0.77	x	1.7	x	74.68	x	0.63	x	0.7	=	38.8	(74)
North	0.9x	0.77	x	1.7	x	59.25	x	0.63	x	0.7	=	30.78	(74)
North	0.9x	0.77	x	4.88	x	59.25	x	0.63	x	0.7	=	88.36	(74)
North	0.9x	0.77	x	1.7	x	59.25	x	0.63	x	0.7	=	30.78	(74)
North	0.9x	0.77	x	1.7	x	41.52	x	0.63	x	0.7	=	21.57	(74)
North	0.9x	0.77	x	4.88	x	41.52	x	0.63	x	0.7	=	61.92	(74)
North	0.9x	0.77	x	1.7	x	41.52	x	0.63	x	0.7	=	21.57	(74)
North	0.9x	0.77	x	1.7	x	24.19	x	0.63	x	0.7	=	12.57	(74)
North	0.9x	0.77	x	4.88	x	24.19	x	0.63	x	0.7	=	36.08	(74)
North	0.9x	0.77	x	1.7	x	24.19	x	0.63	x	0.7	=	12.57	(74)
North	0.9x	0.77	x	1.7	x	13.12	x	0.63	x	0.7	=	6.82	(74)
North	0.9x	0.77	x	4.88	x	13.12	x	0.63	x	0.7	=	19.56	(74)
North	0.9x	0.77	x	1.7	x	13.12	x	0.63	x	0.7	=	6.82	(74)
North	0.9x	0.77	x	1.7	x	8.86	x	0.63	x	0.7	=	4.61	(74)
North	0.9x	0.77	x	4.88	x	8.86	x	0.63	x	0.7	=	13.22	(74)
North	0.9x	0.77	x	1.7	x	8.86	x	0.63	x	0.7	=	4.61	(74)
East	0.9x	1	x	7.42	x	19.64	x	0.63	x	0.7	=	44.54	(76)
East	0.9x	1	x	7.42	x	38.42	x	0.63	x	0.7	=	87.12	(76)
East	0.9x	1	x	7.42	x	63.27	x	0.63	x	0.7	=	143.48	(76)
East	0.9x	1	x	7.42	x	92.28	x	0.63	x	0.7	=	209.26	(76)
East	0.9x	1	x	7.42	x	113.09	x	0.63	x	0.7	=	256.45	(76)
East	0.9x	1	x	7.42	x	115.77	x	0.63	x	0.7	=	262.53	(76)
East	0.9x	1	x	7.42	x	110.22	x	0.63	x	0.7	=	249.94	(76)

East	0.9x	1	x	7.42	x	94.68	x	0.63	x	0.7	=	214.69	(76)
East	0.9x	1	x	7.42	x	73.59	x	0.63	x	0.7	=	166.87	(76)
East	0.9x	1	x	7.42	x	45.59	x	0.63	x	0.7	=	103.38	(76)
East	0.9x	1	x	7.42	x	24.49	x	0.63	x	0.7	=	55.53	(76)
East	0.9x	1	x	7.42	x	16.15	x	0.63	x	0.7	=	36.63	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	71.44	138.55	230.86	349.61	445.52	464.93	438.9	364.61	271.93	164.59	88.73	59.06	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	463.85	528.99	608.89	707.62	783.27	783.07	744.25	675.61	593.15	506.03	453.41	441.1	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.8	0.59	0.44	0.5	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.89	20.04	20.3	20.65	20.89	20.98	21	20.99	20.93	20.6	20.18	19.87	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.01	20.01	20.01	20.03	20.03	20.04	20.04	20.04	20.04	20.03	20.02	20.02	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.74	0.51	0.35	0.4	0.7	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.53	18.75	19.14	19.63	19.93	20.03	20.04	20.04	19.98	19.57	18.97	18.51	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.07	19.27	19.6	20.04	20.31	20.41	20.42	20.42	20.36	19.98	19.46	19.05	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.07	19.27	19.6	20.04	20.31	20.41	20.42	20.42	20.36	19.98	19.46	19.05	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.76	0.55	0.38	0.44	0.73	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	461.45	523.36	591.42	641.89	593.09	426.88	285.28	298.43	434.57	479.29	448.56	439.32	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1146.07	1111.16	1010.47	846.72	653.13	435.18	286.3	300.53	471	711.32	942.23	1138.52	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	509.36	395.01	311.77	147.47	44.67	0	0	0	0	172.63	355.44	520.21	

Total per year (kWh/year) = $\mathrm{Sum}(98)_{1...5,9...12}$ = | 2456.56 | (98)

Space heating requirement in kWh/m²/year | 34.51 | (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	509.36	395.01	311.77	147.47	44.67	0	0	0	0	172.63	355.44	520.21		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	544.77	422.47	333.45	157.73	47.78	0	0	0	0	184.63	380.15	556.37		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													2627.34	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	190.5	167.95	176.47	158.32	155.24	138.85	133.47	146.29	145.98	164.17	173.43	185.96		
Efficiency of water heater													79.8	(216)
(217)m=	87.31	87.02	86.32	84.63	81.97	79.8	79.8	79.8	79.8	84.95	86.69	87.41		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	218.18	193	204.45	187.09	189.4	173.99	167.26	183.32	182.93	193.25	200.06	212.74		
Total = Sum(219a)$_{1...12}$ =													2305.67	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2627.34	
Water heating fuel used			2305.67	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			315.03	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	567.51	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	498.02	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1065.53	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	163.5	(268)
Total CO2, kg/year		sum of (265)…(271) =		1267.95	(272)

TER = 17.81 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-8-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	71.42	(1a)	x	2.4	(2a)	=	171.41	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.42	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			171.41	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Walls Type1	28.74	10.12	18.62	x	0.18	=	3.35			(29)
Walls Type2	43.06	2.1	40.96	x	0.18	=	7.37			(29)
Roof	17.74	0	17.74	x	0.11	=	1.95			(30)
Total area of elements, m²			89.54							(31)
Party wall			14.79	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 26.78 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 13.15 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 39.93 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	

Average = Sum(39)$_{1…12}$ /12= 68.21 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96

Average = Sum(40)$_{1…12}$ /12= 0.96 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.28 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	97.19	93.65	90.12	86.59	83.05	79.52	79.52	83.05	86.59	90.12	93.65	97.19	
										Total = Sum(44)$_{1…12}$ =		1060.23	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	144.13	126.05	130.08	113.4	108.81	93.9	87.01	99.85	101.04	117.75	128.53	139.58	
										Total = Sum(45)$_{1…12}$ =		1390.13	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	21.62	18.91	19.51	17.01	16.32	14.08	13.05	14.98	15.16	17.66	19.28	20.94	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.4	175.98	185.35	166.9	164.09	147.39	142.29	155.12	154.53	173.03	182.03	194.86	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.4	175.98	185.35	166.9	164.09	147.39	142.29	155.12	154.53	173.03	182.03	194.86	

Output from water heater (annual)$_{1\ldots12}$ 2040.97 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.14	81.85	87.47	80.5	80.4	74.02	73.15	77.42	76.39	83.37	85.53	90.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114	114	114	114	114	114	114	114	114	114	114	114	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.61	16.53	13.44	10.18	7.61	6.42	6.94	9.02	12.11	15.37	17.94	19.13	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.59	202.67	197.42	186.26	172.16	158.91	150.06	147.98	153.23	164.39	178.49	191.74	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	(71)

Water heating gains (Table 5)

(72)m=	123.85	121.81	117.57	111.81	108.07	102.8	98.32	104.06	106.1	112.06	118.79	121.82	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	400.25	398.21	385.64	365.45	345.04	325.34	312.53	318.26	328.64	349.03	372.43	389.89	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)

East	0.9x	1	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	55.1	107.78	177.5	258.87	317.25	324.77	309.19	265.59	206.44	127.89	68.7	45.31	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	455.35	505.99	563.14	624.32	662.29	650.11	621.72	583.86	535.07	476.92	441.13	435.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.83	0.65	0.48	0.53	0.79	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.07	20.19	20.41	20.68	20.89	20.98	21	20.99	20.94	20.66	20.31	20.03	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.79	0.57	0.39	0.43	0.72	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.87	19.05	19.37	19.75	20.01	20.11	20.12	20.12	20.07	19.73	19.22	18.82	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.51	19.78	20.12	20.36	20.46	20.47	20.47	20.42	20.1	19.65	19.3	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.51	19.78	20.12	20.36	20.46	20.47	20.47	20.42	20.1	19.65	19.3	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.8	0.6	0.42	0.47	0.75	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	453.15	501.21	549.39	577.81	530.66	390.22	263.01	275.67	400.37	453.04	436.66	433.56	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1026.57	996.29	906.01	765.3	591.03	399.49	264.03	277.57	431	648.14	856.38	1030.24	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	426.62	332.7	265.32	134.99	44.92	0	0	0	0	145.16	302.2	443.93	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2095.83 (98)

Space heating requirement in kWh/m²/year 29.35 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating	**kWh/year**
Annual space heating requirement	2095.83

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Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1650.47	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	550.16	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2040.97	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1607.26	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	535.75	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.44	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.22	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	46.22	(331)
Energy for lighting (calculated in Appendix L)		328.7	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit	32	(361)
Heat efficiency of CHP unit	38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4343.34	x	0.22		938.16	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1389.87	x	0.52		-721.34	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4229.63	x	0.22		913.6	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1353.48	x	0.52		-702.46	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	252.21	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	22.54	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	702.72	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					702.72	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	23.99	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	170.6	(379)
Total CO2, kg/year	sum of (376)…(382) =					897.3	(383)

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Dwelling CO2 Emission Rate	(383) ÷ (4) =	12.56	(384)
EI rating (section 14)		89.67	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-8-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.42	(1a) x	2.4	(2a) =	171.41	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.42	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.41	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.43	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Walls Type1	28.74	10.12	18.62	x	0.18	=	3.35			(29)
Walls Type2	43.06	2.1	40.96	x	0.18	=	7.37			(29)
Roof	17.74	0	17.74	x	0.13	=	2.31			(30)
Total area of elements, m²			89.54							(31)
Party wall			14.79	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.55 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.24 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 36.79 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.28	34.05	33.82	32.75	32.55	31.61	31.61	31.44	31.97	32.55	32.95	33.38	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	71.07	70.84	70.61	69.53	69.33	68.4	68.4	68.23	68.76	69.33	69.74	70.16	

Average = Sum(39)$_{1…12}$ /12= 69.53 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(40)m=	1	0.99	0.99	0.97	0.97	0.96	0.96	0.96	0.96	0.97	0.98	0.98		
											Average = Sum(40)1…12 /12=		0.97	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.28 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)														
(44)m=	97.19	93.65	90.12	86.59	83.05	79.52	79.52	83.05	86.59	90.12	93.65	97.19		
										Total = Sum(44)1…12 =			1060.23	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)														
(45)m=	144.13	126.05	130.08	113.4	108.81	93.9	87.01	99.85	101.04	117.75	128.53	139.58		
										Total = Sum(45)1…12 =			1390.13	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)														
(46)m=	21.62	18.91	19.51	17.01	16.32	14.08	13.05	14.98	15.16	17.66	19.28	20.94		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	190.72	168.14	176.67	158.5	155.41	138.99	133.61	146.44	146.13	164.34	173.63	186.17	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	190.72	168.14	176.67	158.5	155.41	138.99	133.61	146.44	146.13	164.34	173.63	186.17	

Output from water heater (annual)$_{1...12}$ 1938.74 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.2	75.58	80.53	73.78	73.46	67.29	66.21	70.47	69.67	76.43	78.81	83.69	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114	114	114	114	114	114	114	114	114	114	114	114	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	19.13	17	13.82	10.46	7.82	6.6	7.14	9.27	12.45	15.81	18.45	19.67	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	200.59	202.67	197.42	186.26	172.16	158.91	150.06	147.98	153.23	164.39	178.49	191.74	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	(71)
Water heating gains (Table 5)													
(72)m=	114.51	112.47	108.23	102.47	98.73	93.46	88.99	94.72	96.76	102.73	109.46	112.48	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	394.44	392.34	379.68	359.4	338.92	319.18	306.39	312.18	322.64	343.13	366.6	384.09	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)

East	0.9x	1	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	60.74	118.83	195.69	285.4	349.77	358.06	340.88	292.81	227.6	141	75.74	49.95	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	455.18	511.17	575.37	644.8	688.69	677.24	647.27	605	550.24	484.13	442.34	434.04	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.82	0.63	0.46	0.51	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.01	20.14	20.38	20.68	20.89	20.98	21	21	20.94	20.65	20.28	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.09	20.09	20.09	20.11	20.11	20.12	20.12	20.12	20.11	20.11	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.77	0.55	0.37	0.42	0.71	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.76	18.96	19.3	19.73	20.01	20.11	20.12	20.12	20.07	19.71	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.26	19.43	19.73	20.11	20.36	20.46	20.47	20.47	20.42	20.09	19.62	19.24	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.26	19.43	19.73	20.11	20.36	20.46	20.47	20.47	20.42	20.09	19.62	19.24	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.92	0.79	0.58	0.41	0.46	0.74	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	453.02	506.26	560.75	593.08	542.82	392.78	263.83	276.06	405.44	459.19	437.89	432.44	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1063.25	1029.58	934.43	779.68	600.55	400.65	264.68	277.65	434.4	657.82	872.82	1055.31	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	454.01	351.67	278.02	134.35	42.95	0	0	0	0	147.78	313.15	463.42	

Total per year (kWh/year) = Sum(98)1...5,9...12 = 2185.35 (98)

Space heating requirement in kWh/m²/year 30.6 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	454.01	351.67	278.02	134.35	42.95	0	0	0	0	147.78	313.15	463.42	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	485.57	376.12	297.35	143.69	45.93	0	0	0	0	158.05	334.92	495.63	

Total (kWh/year) =Sum(211)1...5,10...12= 2337.27 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)1...5,10...12= 0 (215)

TER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

	190.72	168.14	176.67	158.5	155.41	138.99	133.61	146.44	146.13	164.34	173.63	186.17	
Efficiency of water heater													79.8 (216)
(217)m=	87.05	86.74	86.02	84.38	81.9	79.8	79.8	79.8	79.8	84.53	86.37	87.15	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	219.1	193.85	205.39	187.84	189.76	174.17	167.42	183.51	183.12	194.42	201.03	213.62

Total = Sum(219a)$_{1...12}$ = 2313.23 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2337.27	
Water heating fuel used		2313.23	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year — sum of (230a)…(230g) =		75	(231)
Electricity for lighting		337.92	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216 =	504.85	(261)
Space heating (secondary)	(215) x	0.519 =	0	(263)
Water heating	(219) x	0.216 =	499.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =		1004.51	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93	(267)
Electricity for lighting	(232) x	0.519 =	175.38	(268)
Total CO2, kg/year		sum of (265)…(271) =	1218.82	(272)

TER = 17.07 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b1-8-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.03	(1a) x	2.4	(2a) =	170.47	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.03	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.47	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Walls Type1	25.33	9.2	16.13	x	0.18	=	2.9			(29)
Walls Type2	13.71	2.1	11.61	x	0.18	=	2.09			(29)
Roof	10.34	0	10.34	x	0.11	=	1.14			(30)
Total area of elements, m²			49.38							(31)
Party wall			52.54	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.18 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 16.21 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 35.4 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	63.52	63.52	63.52	63.52	63.52	63.52	63.52	63.52	63.52	63.52	63.52	63.52	

Average = Sum(39)$_{1…12}$ /12= 63.52 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	

Average = Sum(40)$_{1…12}$ /12= 0.89 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.27 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.95	93.42	89.9	86.37	82.85	79.32	79.32	82.85	86.37	89.9	93.42	96.95	

Total = Sum(44)$_{1…12}$ = 1057.6 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.77	125.74	129.75	113.12	108.54	93.66	86.79	99.6	100.79	117.46	128.21	139.23	

Total = Sum(45)$_{1…12}$ = 1386.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.57	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.88	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.05	175.67	185.03	166.62	163.82	147.16	142.07	154.87	154.28	172.73	181.71	194.51	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.05	175.67	185.03	166.62	163.82	147.16	142.07	154.87	154.28	172.73	181.71	194.51	

Output from water heater (annual)$_{1...12}$ 2037.52 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.02	81.75	87.36	80.41	80.31	73.94	73.08	77.34	76.31	83.28	85.43	90.52	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	18.87	16.76	13.63	10.32	7.71	6.51	7.04	9.15	12.28	15.59	18.19	19.4	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	199.69	201.76	196.54	185.42	171.39	158.2	149.39	147.32	152.54	163.66	177.69	190.88	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	(71)
Water heating gains (Table 5)													
(72)m=	123.69	121.65	117.43	111.68	107.95	102.69	98.23	103.95	105.98	111.93	118.65	121.66	(72)
Total internal gains =						(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m							
(73)m=	399.31	397.24	384.66	364.48	344.11	324.47	311.72	317.48	327.86	348.24	371.59	389	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)

West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	50.09	97.98	161.36	235.34	288.41	295.24	281.08	241.45	187.67	116.26	62.45	41.19	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	449.4	495.22	546.02	599.82	632.53	619.71	592.8	558.92	515.53	464.5	434.05	430.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.83	0.64	0.47	0.52	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.26	20.47	20.72	20.91	20.98	21	21	20.95	20.7	20.37	20.12	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.78	0.56	0.38	0.43	0.71	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.03	19.2	19.49	19.84	20.08	20.16	20.17	20.17	20.13	19.83	19.36	18.98	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.48	19.63	19.88	20.19	20.41	20.49	20.5	20.5	20.46	20.18	19.77	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.48	19.63	19.88	20.19	20.41	20.49	20.5	20.5	20.46	20.18	19.77	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.8	0.59	0.42	0.46	0.74	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	447.24	490.59	532.79	554.84	504.33	367.49	247.22	259.27	380.6	440.29	429.57	428.59	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	964.32	935.44	850.13	717.43	553.56	374.25	247.88	260.52	404.1	608.6	804.54	967.84	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	384.7	298.94	236.1	117.07	36.63	0	0	0	0	125.22	269.98	401.2	

Total per year (kWh/year) = Sum(98)1...5,9...12 = 1869.84 (98)

Space heating requirement in kWh/m²/year 26.32 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating **kWh/year**

Annual space heating requirement 1869.84

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Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1472.5	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	490.83	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2037.52	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1604.54	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	534.85	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	41.03	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		45.96	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	45.96	(331)
Energy for lighting (calculated in Appendix L)		333.28	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit					32	(361)
Heat efficiency of CHP unit					38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**	**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	3875	x	0.22	837	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1240	x	0.52	-643.56	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4222.49	x	0.22	912.06	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1351.2	x	0.52	-701.27	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22 =	238.22	(368)
Electrical energy for heat distribution	[(313) x			0.52 =	21.29	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	663.74	(373)
CO2 associated with space heating (secondary)	(309) x			0 =	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22 =	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				663.74	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52 =	23.85	(378)
CO2 associated with electricity for lighting	(332))) x			0.52 =	172.97	(379)
Total CO2, kg/year	sum of (376)…(382) =				860.57	(383)

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Dwelling CO2 Emission Rate	(383) ÷ (4) =	12.12	(384)
EI rating (section 14)		90.06	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-8-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.03	(1a) x	2.4	(2a) =	170.47	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.03	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.47	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.43	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

TER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 3			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Walls Type1	25.33	9.2	16.13	x	0.18	=	2.9			(29)
Walls Type2	13.71	2.1	11.61	x	0.18	=	2.09			(29)
Roof	10.34	0	10.34	x	0.13	=	1.34			(30)
Total area of elements, m²			49.38							(31)
Party wall			52.54	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	20.63	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		5.68	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	26.32	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.12	33.89	33.66	32.59	32.39	31.46	31.46	31.28	31.82	32.39	32.8	33.22	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	60.44	60.21	59.98	58.91	58.71	57.77	57.77	57.6	58.13	58.71	59.11	59.54	

Average = Sum(39)$_{1…12}$ /12= 58.91 (39)

TER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.85	0.85	0.84	0.83	0.83	0.81	0.81	0.81	0.82	0.83	0.83	0.84

Average = Sum(40)$_{1…12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.27 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.95	93.42	89.9	86.37	82.85	79.32	79.32	82.85	86.37	89.9	93.42	96.95

Total = Sum(44)$_{1…12}$ = 1057.6 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.77	125.74	129.75	113.12	108.54	93.66	86.79	99.6	100.79	117.46	128.21	139.23

Total = Sum(45)$_{1…12}$ = 1386.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.57	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.88	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	190.36	167.83	176.35	158.21	155.14	138.76	133.39	146.19	145.88	164.05	173.31	185.83	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	190.36	167.83	176.35	158.21	155.14	138.76	133.39	146.19	145.88	164.05	173.31	185.83	

Output from water heater (annual)$_{1...12}$ 1935.29 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.08	75.48	80.42	73.69	73.37	67.22	66.13	70.39	69.59	76.33	78.7	83.57	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.43	17.26	14.03	10.62	7.94	6.7	7.24	9.42	12.64	16.05	18.73	19.97	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.69	201.76	196.54	185.42	171.39	158.2	149.39	147.32	152.54	163.66	177.69	190.88	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	(71)

Water heating gains (Table 5)

(72)m=	114.35	112.32	108.09	102.34	98.61	93.36	88.89	94.61	96.65	102.59	109.31	112.33	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	393.53	391.4	378.73	358.45	338.01	318.33	305.59	311.41	321.89	342.36	365.8	383.24	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)

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West	0.9x	0.77	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	55.22	108.02	177.9	259.46	317.98	325.5	309.89	266.19	206.91	128.18	68.85	45.41	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	448.76	499.42	556.63	617.91	655.98	643.83	615.48	577.61	528.8	470.54	434.65	428.65	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.78	0.57	0.41	0.46	0.73	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.34	20.55	20.8	20.95	20.99	21	21	20.98	20.77	20.45	20.2	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(88)m=	20.21	20.21	20.21	20.23	20.23	20.24	20.24	20.24	20.24	20.23	20.23	20.22		(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.73	0.5	0.34	0.38	0.66	0.93	0.99	1		(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.16	19.34	19.64	20	20.18	20.24	20.24	20.24	20.22	19.97	19.52	19.14		(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.58	19.74	20	20.32	20.49	20.54	20.54	20.55	20.52	20.29	19.89	19.56		(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.58	19.74	20	20.32	20.49	20.54	20.54	20.55	20.52	20.29	19.89	19.56		(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	1	0.99	0.97	0.9	0.75	0.53	0.37	0.41	0.68	0.94	0.99	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	446.53	494.21	540.33	557.31	489.09	340.82	227.72	238.42	361.69	440.13	429.69	427.02		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	923.48	893.34	809.81	672.63	516.02	343.22	227.9	238.79	373.31	568.96	756.07	914.66		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	354.85	268.21	200.5	83.04	20.03	0	0	0	0	95.85	234.99	362.8		

Total per year (kWh/year) = Sum(98)1...5,9...12 = 1620.27 (98)

Space heating requirement in kWh/m²/year 22.81 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	354.85	268.21	200.5	83.04	20.03	0	0	0	0	95.85	234.99	362.8		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	379.51	286.86	214.44	88.81	21.43	0	0	0	0	102.51	251.33	388.02		

Total (kWh/year) =Sum(211)1...5,10...12= 1732.91 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		

Total (kWh/year) =Sum(215)1...5,10...12= 0 (215)

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Water heating

Output from water heater (calculated above)

	190.36	167.83	176.35	158.21	155.14	138.76	133.39	146.19	145.88	164.05	173.31	185.83	
Efficiency of water heater													79.8 (216)
(217)m=	86.45	86.06	85.16	83.19	80.89	79.8	79.8	79.8	79.8	83.44	85.63	86.57	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	220.19	195.01	207.09	190.2	191.78	173.88	167.15	183.2	182.81	196.62	202.4	214.66

Total = Sum(219a)$_{1...12}$ = 2324.98 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1732.91	
Water heating fuel used		2324.98	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		343.11	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	374.31	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	502.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =			876.5	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	178.07	(268)
Total CO2, kg/year		sum of (265)…(271) =		1093.5	(272)

TER = 15.39 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-8-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.5	(1a) x	2.4	(2a) =	178.8	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.5	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		178.8	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 5			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Walls Type1	39.17	17.25	21.92	x	0.18	=	3.95			(29)
Walls Type2	5.47	2.1	3.37	x	0.18	=	0.61			(29)
Roof	74.5	0	74.5	x	0.11	=	8.19			(30)
Total area of elements, m²			119.14							(31)
Party wall			51.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	35.02	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		15.71	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	50.73	(37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	80.23	80.23	80.23	80.23	80.23	80.23	80.23	80.23	80.23	80.23	80.23	80.23	

Average = Sum(39)$_{1…12}$ /12= 80.23 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	

Average = Sum(40)$_{1…12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.02 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	99.02	95.42	91.82	88.22	84.62	81.02	81.02	84.62	88.22	91.82	95.42	99.02	

Total = Sum(44)$_{1…12}$ = 1080.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.84	128.43	132.53	115.54	110.87	95.67	88.65	101.73	102.94	119.97	130.96	142.21	

Total = Sum(45)$_{1…12}$ = 1416.34 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.03	19.26	19.88	17.33	16.63	14.35	13.3	15.26	15.44	18	19.64	21.33	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.12	178.36	187.81	169.04	166.14	149.16	143.93	157	156.44	175.25	184.45	197.49	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.12	178.36	187.81	169.04	166.14	149.16	143.93	157	156.44	175.25	184.45	197.49

Output from water heater (annual)$_{1…12}$ — 2067.18 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.05	82.65	88.29	81.21	81.08	74.6	73.7	78.05	77.02	84.11	86.34	91.51	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.5	16.44	13.37	10.12	7.56	6.39	6.9	8.97	12.04	15.29	17.84	19.02	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	207.56	209.72	204.29	192.74	178.15	164.44	155.28	153.13	158.56	170.11	184.7	198.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	(71)

Water heating gains (Table 5)

(72)m=	125.06	122.98	118.67	112.8	108.98	103.62	99.06	104.9	106.98	113.05	119.91	122.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	409.39	407.39	394.58	373.9	352.95	332.7	319.49	325.25	335.83	356.7	380.71	398.67	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)

West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	73.82	143.33	238.41	359.1	455.14	473.73	447.72	373.65	280.31	170.24	91.72	60.97	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	483.2	550.72	632.99	733.01	808.09	806.42	767.21	698.9	616.14	526.94	472.43	459.64	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.81	0.61	0.46	0.52	0.79	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.9	20.05	20.31	20.63	20.88	20.98	21	20.99	20.92	20.58	20.18	19.86	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.91	0.75	0.53	0.36	0.41	0.72	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.56	18.77	19.15	19.6	19.91	20.01	20.02	20.02	19.96	19.54	18.96	18.5	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.1	19.28	19.61	20.01	20.3	20.39	20.41	20.41	20.34	19.96	19.44	19.05	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.1	19.28	19.61	20.01	20.3	20.39	20.41	20.41	20.34	19.96	19.44	19.05	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.77	0.56	0.4	0.46	0.74	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	480.75	544.95	615.17	667.86	620.53	453.88	304.23	318.63	457.84	499.99	467.49	457.82	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1187.24	1153.93	1051.83	891.67	689.64	464.85	305.63	321.48	500.68	750.89	990.37	1191.19	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	525.63	409.24	324.88	161.14	51.42	0	0	0	0	186.67	376.47	545.63	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2581.07 (98)

Space heating requirement in kWh/m²/year 34.65 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2581.07	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	2032.6	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	677.53	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2067.18	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1627.9	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	542.63	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	48.81	(313)

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Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		48.21	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	48.21	(331)
Energy for lighting (calculated in Appendix L)		326.8	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	5348.94	x	0.22		1155.37	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1711.66	x	0.52		-888.35	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4283.95	x	0.22		925.33	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1370.87	x	0.52		-711.48	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	283.39	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	25.33	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	789.6	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					789.6	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	25.02	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	169.61	(379)
Total CO2, kg/year	sum of (376)…(382) =					984.22	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					13.21	(384)
EI rating (section 14)						88.96	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-8-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	74.5	(1a)	x	2.4	(2a)	=	178.8	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.5	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	178.8	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

TER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.76	x1/[1/(1.4)+ 0.04]		=	2.33			(27)
Windows Type 2			2.64	x1/[1/(1.4)+ 0.04]		=	3.5			(27)
Windows Type 3			2.64	x1/[1/(1.4)+ 0.04]		=	3.5			(27)
Windows Type 4			5.07	x1/[1/(1.4)+ 0.04]		=	6.72			(27)
Windows Type 5			4.41	x1/[1/(1.4)+ 0.04]		=	5.85			(27)
Walls Type1	39.17	16.52	22.65	x	0.18	=	4.08			(29)
Walls Type2	5.47	2.1	3.37	x	0.18	=	0.61			(29)
Roof	74.5	0	74.5	x	0.13	=	9.68			(30)
Total area of elements, m²			119.14							(31)
Party wall			51.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	38.37	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		7.23	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	45.6	(37)

TER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.55	35.32	35.09	34	33.8	32.86	32.86	32.69	33.22	33.8	34.21	34.64	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	81.15	80.91	80.68	79.6	79.4	78.46	78.46	78.28	78.82	79.4	79.81	80.23	

Average = Sum(39)$_{1…12}$ /12= 79.6 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.09	1.09	1.08	1.07	1.07	1.05	1.05	1.05	1.06	1.07	1.07	1.08	

Average = Sum(40)$_{1…12}$ /12= 1.07 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.02 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	99.02	95.42	91.82	88.22	84.62	81.02	81.02	84.62	88.22	91.82	95.42	99.02	

Total = Sum(44)$_{1…12}$ = 1080.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.84	128.43	132.53	115.54	110.87	95.67	88.65	101.73	102.94	119.97	130.96	142.21	

Total = Sum(45)$_{1…12}$ = 1416.34 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.03	19.26	19.88	17.33	16.63	14.35	13.3	15.26	15.44	18	19.64	21.33	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

TER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	193.44	170.52	179.12	160.63	157.46	140.76	135.25	148.32	148.03	166.56	176.05	188.81	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	193.44	170.52	179.12	160.63	157.46	140.76	135.25	148.32	148.03	166.56	176.05	188.81

Output from water heater (annual)$_{1...12}$ — 1964.96 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.1	76.37	81.34	74.49	74.14	67.88	66.75	71.1	70.3	77.17	79.62	84.56	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.51	16.44	13.37	10.12	7.57	6.39	6.9	8.97	12.04	15.29	17.84	19.02	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	207.56	209.72	204.29	192.74	178.15	164.44	155.28	153.13	158.56	170.11	184.7	198.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	(71)

Water heating gains (Table 5)

(72)m=	115.73	113.65	109.33	103.46	99.65	94.28	89.72	95.57	97.64	103.72	110.58	113.66	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	403.05	401.06	388.24	367.57	346.62	326.36	313.16	318.92	329.49	350.37	374.37	392.34	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	2.64	x	10.63	x	0.63	x	0.7	=	8.58	(74)
North	0.9x	0.77	x	5.07	x	10.63	x	0.63	x	0.7	=	16.48	(74)
North	0.9x	0.77	x	2.64	x	20.32	x	0.63	x	0.7	=	16.4	(74)
North	0.9x	0.77	x	5.07	x	20.32	x	0.63	x	0.7	=	31.49	(74)
North	0.9x	0.77	x	2.64	x	34.53	x	0.63	x	0.7	=	27.86	(74)
North	0.9x	0.77	x	5.07	x	34.53	x	0.63	x	0.7	=	53.5	(74)
North	0.9x	0.77	x	2.64	x	55.46	x	0.63	x	0.7	=	44.75	(74)
North	0.9x	0.77	x	5.07	x	55.46	x	0.63	x	0.7	=	85.94	(74)
North	0.9x	0.77	x	2.64	x	74.72	x	0.63	x	0.7	=	60.28	(74)
North	0.9x	0.77	x	5.07	x	74.72	x	0.63	x	0.7	=	115.77	(74)
North	0.9x	0.77	x	2.64	x	79.99	x	0.63	x	0.7	=	64.53	(74)
North	0.9x	0.77	x	5.07	x	79.99	x	0.63	x	0.7	=	123.93	(74)
North	0.9x	0.77	x	2.64	x	74.68	x	0.63	x	0.7	=	60.25	(74)
North	0.9x	0.77	x	5.07	x	74.68	x	0.63	x	0.7	=	115.71	(74)
North	0.9x	0.77	x	2.64	x	59.25	x	0.63	x	0.7	=	47.8	(74)
North	0.9x	0.77	x	5.07	x	59.25	x	0.63	x	0.7	=	91.8	(74)
North	0.9x	0.77	x	2.64	x	41.52	x	0.63	x	0.7	=	33.5	(74)
North	0.9x	0.77	x	5.07	x	41.52	x	0.63	x	0.7	=	64.33	(74)
North	0.9x	0.77	x	2.64	x	24.19	x	0.63	x	0.7	=	19.52	(74)
North	0.9x	0.77	x	5.07	x	24.19	x	0.63	x	0.7	=	37.48	(74)
North	0.9x	0.77	x	2.64	x	13.12	x	0.63	x	0.7	=	10.58	(74)
North	0.9x	0.77	x	5.07	x	13.12	x	0.63	x	0.7	=	20.33	(74)
North	0.9x	0.77	x	2.64	x	8.86	x	0.63	x	0.7	=	7.15	(74)
North	0.9x	0.77	x	5.07	x	8.86	x	0.63	x	0.7	=	13.74	(74)
West	0.9x	0.77	x	1.76	x	19.64	x	0.63	x	0.7	=	10.56	(80)
West	0.9x	0.77	x	2.64	x	19.64	x	0.63	x	0.7	=	15.85	(80)
West	0.9x	0.77	x	4.41	x	19.64	x	0.63	x	0.7	=	26.47	(80)
West	0.9x	0.77	x	1.76	x	38.42	x	0.63	x	0.7	=	20.67	(80)
West	0.9x	0.77	x	2.64	x	38.42	x	0.63	x	0.7	=	31	(80)
West	0.9x	0.77	x	4.41	x	38.42	x	0.63	x	0.7	=	51.78	(80)
West	0.9x	0.77	x	1.76	x	63.27	x	0.63	x	0.7	=	34.03	(80)
West	0.9x	0.77	x	2.64	x	63.27	x	0.63	x	0.7	=	51.05	(80)
West	0.9x	0.77	x	4.41	x	63.27	x	0.63	x	0.7	=	85.28	(80)
West	0.9x	0.77	x	1.76	x	92.28	x	0.63	x	0.7	=	49.64	(80)
West	0.9x	0.77	x	2.64	x	92.28	x	0.63	x	0.7	=	74.45	(80)
West	0.9x	0.77	x	4.41	x	92.28	x	0.63	x	0.7	=	124.37	(80)
West	0.9x	0.77	x	1.76	x	113.09	x	0.63	x	0.7	=	60.83	(80)
West	0.9x	0.77	x	2.64	x	113.09	x	0.63	x	0.7	=	91.25	(80)
West	0.9x	0.77	x	4.41	x	113.09	x	0.63	x	0.7	=	152.42	(80)
West	0.9x	0.77	x	1.76	x	115.77	x	0.63	x	0.7	=	62.27	(80)
West	0.9x	0.77	x	2.64	x	115.77	x	0.63	x	0.7	=	93.41	(80)

West	0.9x	0.77	x	4.41	x	115.77	x	0.63	x	0.7	=	156.03	(80)
West	0.9x	0.77	x	1.76	x	110.22	x	0.63	x	0.7	=	59.28	(80)
West	0.9x	0.77	x	2.64	x	110.22	x	0.63	x	0.7	=	88.93	(80)
West	0.9x	0.77	x	4.41	x	110.22	x	0.63	x	0.7	=	148.55	(80)
West	0.9x	0.77	x	1.76	x	94.68	x	0.63	x	0.7	=	50.92	(80)
West	0.9x	0.77	x	2.64	x	94.68	x	0.63	x	0.7	=	76.39	(80)
West	0.9x	0.77	x	4.41	x	94.68	x	0.63	x	0.7	=	127.6	(80)
West	0.9x	0.77	x	1.76	x	73.59	x	0.63	x	0.7	=	39.58	(80)
West	0.9x	0.77	x	2.64	x	73.59	x	0.63	x	0.7	=	59.37	(80)
West	0.9x	0.77	x	4.41	x	73.59	x	0.63	x	0.7	=	99.18	(80)
West	0.9x	0.77	x	1.76	x	45.59	x	0.63	x	0.7	=	24.52	(80)
West	0.9x	0.77	x	2.64	x	45.59	x	0.63	x	0.7	=	36.78	(80)
West	0.9x	0.77	x	4.41	x	45.59	x	0.63	x	0.7	=	61.44	(80)
West	0.9x	0.77	x	1.76	x	24.49	x	0.63	x	0.7	=	13.17	(80)
West	0.9x	0.77	x	2.64	x	24.49	x	0.63	x	0.7	=	19.76	(80)
West	0.9x	0.77	x	4.41	x	24.49	x	0.63	x	0.7	=	33.01	(80)
West	0.9x	0.77	x	1.76	x	16.15	x	0.63	x	0.7	=	8.69	(80)
West	0.9x	0.77	x	2.64	x	16.15	x	0.63	x	0.7	=	13.03	(80)
West	0.9x	0.77	x	4.41	x	16.15	x	0.63	x	0.7	=	21.77	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	77.94	151.33	251.72	379.15	480.55	500.17	472.72	394.51	295.96	179.74	96.84	64.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	480.99	552.38	639.96	746.72	827.16	826.54	785.87	713.43	625.45	530.11	471.22	456.71	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.79	0.59	0.44	0.5	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.88	20.04	20.31	20.65	20.89	20.98	21	20.99	20.93	20.6	20.18	19.86	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.01	20.01	20.01	20.03	20.03	20.04	20.04	20.04	20.04	20.03	20.02	20.02	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.74	0.51	0.34	0.4	0.7	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.52	18.75	19.14	19.63	19.93	20.03	20.04	20.04	19.98	19.57	18.97	18.5	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.07	19.27	19.61	20.04	20.31	20.41	20.42	20.42	20.36	19.98	19.45	19.04	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.07	19.27	19.61	20.04	20.31	20.41	20.42	20.42	20.36	19.98	19.45	19.04	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	1	0.99	0.97	0.9	0.75	0.54	0.38	0.44	0.73	0.95	0.99	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	478.59	546.55	621.31	675.65	622.79	447.39	298.82	312.66	456.01	502.02	466.33	454.95		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	1198.38	1162.39	1057.6	886.83	683.99	455.81	299.84	314.78	493.33	744.71	985.82	1190.85		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	535.52	413.84	324.6	152.05	45.54	0	0	0	0	180.56	374.03	547.51		
Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =													2573.65	(98)
Space heating requirement in kWh/m²/year													34.55	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	535.52	413.84	324.6	152.05	45.54	0	0	0	0	180.56	374.03	547.51		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	572.75	442.61	347.17	162.62	48.7	0	0	0	0	193.11	400.04	585.57		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2752.57	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	193.44	170.52	179.12	160.63	157.46	140.76	135.25	148.32	148.03	166.56	176.05	188.81		
Efficiency of water heater													79.8	(216)
(217)m=	87.39	87.09	86.38	84.67	81.97	79.8	79.8	79.8	79.8	85.03	86.78	87.49		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	221.35	195.79	207.36	189.72	192.09	176.39	169.48	185.87	185.51	195.89	202.88	215.8		
Total = Sum(219a)$_{1...12}$ =													2338.12	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2752.57

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Water heating fuel used			2338.12	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			326.83	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	594.55	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	505.03	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1099.59	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	169.63	(268)
Total CO2, kg/year		sum of (265)…(271) =		1308.14	(272)

TER = 17.56 (273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-9-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.68	(1a) x	2.4	(2a) =	128.83	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.68	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	128.83	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	35.36	12.88	22.48	x	0.18	=	4.05			(29)
Walls Type2	35.36	2.1	33.26	x	0.18	=	5.99			(29)
Roof	17.33	0	17.33	x	0.11	=	1.91			(30)
Total area of elements, m²			88.05							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 29.21 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.98 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 42.19 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	21.26	21.26	21.26	21.26	21.26	21.26	21.26	21.26	21.26	21.26	21.26	21.26	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	63.45	63.45	63.45	63.45	63.45	63.45	63.45	63.45	63.45	63.45	63.45	63.45	

Average = Sum(39)$_{1…12}$ /12= 63.45 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18

Average = Sum(40)$_{1…12}$ /12= 1.18 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.8 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 76.92 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	84.61	81.53	78.45	75.38	72.3	69.22	69.22	72.3	75.38	78.45	81.53	84.61

Total = Sum(44)$_{1…12}$ = 923 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	125.47	109.74	113.24	98.73	94.73	81.74	75.75	86.92	87.96	102.51	111.9	121.51

Total = Sum(45)$_{1…12}$ = 1210.2 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.82	16.46	16.99	14.81	14.21	12.26	11.36	13.04	13.19	15.38	16.78	18.23

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	180.75	159.67	168.52	152.22	150.01	135.24	131.02	142.2	141.45	157.79	165.39	176.79	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	180.75	159.67	168.52	152.22	150.01	135.24	131.02	142.2	141.45	157.79	165.39	176.79	

Output from water heater (annual)$_{1...12}$ 1861.04 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.94	76.43	81.87	75.62	75.72	69.97	69.41	73.12	72.04	78.31	80	84.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.98	12.41	10.1	7.64	5.71	4.82	5.21	6.77	9.09	11.55	13.48	14.37	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	156.78	158.4	154.3	145.58	134.56	124.21	117.29	115.66	119.76	128.49	139.51	149.86	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	(71)

Water heating gains (Table 5)

(72)m=	115.51	113.73	110.05	105.03	101.77	97.19	93.29	98.28	100.06	105.25	111.11	113.74	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	336.24	334.53	324.42	308.23	292.03	276.2	265.77	270.7	278.89	295.26	314.07	327.95	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)

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North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)

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East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36 (76)
East	0.9x	1	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59 (76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	56.34	109.48	181.93	273.14	345.06	358.58	339.13	283.81	213.66	130.02	70.03	46.52	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	392.59	444.01	506.35	581.37	637.08	634.78	604.9	554.51	492.55	425.29	384.11	374.46	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.8	0.61	0.46	0.52	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.84	19.99	20.26	20.6	20.86	20.97	20.99	20.99	20.91	20.56	20.13	19.79	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.9	0.74	0.52	0.35	0.4	0.7	0.94	0.99	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.4	18.62	19.01	19.48	19.8	19.92	19.93	19.93	19.86	19.44	18.83	18.34	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.12	19.3	19.63	20.04	20.33	20.44	20.46	20.46	20.38	20	19.48	19.07	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.12	19.3	19.63	20.04	20.33	20.44	20.46	20.46	20.38	20	19.48	19.07	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.96	0.9	0.76	0.57	0.4	0.46	0.73	0.94	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	389.45	437.36	488.25	523.74	485.82	359.27	243.39	254.38	361.08	398.52	378.19	372.05	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	940.2	913.92	833.35	706.77	547.58	370.69	245.11	257.59	398.74	596.35	785.25	943.29	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	409.76	320.25	256.75	131.78	45.95	0	0	0	0	147.18	293.08	425	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 2029.75 (98)

Space heating requirement in kWh/m²/year 37.81 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2029.75	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1598.43	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	532.81	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1861.04	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1465.57	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	488.52	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	40.85	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		34.74	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	34.74	(331)
Energy for lighting (calculated in Appendix L)		246.84	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4206.39	x	0.22	908.58	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1346.05	x	0.52	-698.6	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	3856.75	x	0.22	833.06	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1234.16	x	0.52	-640.53	(366)

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Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	237.21	(368)
Electrical energy for heat distribution	[(313) x	0.52	=	21.2	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	660.93	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			660.93	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	18.03	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	128.11	(379)
Total CO2, kg/year	sum of (376)…(382) =			807.06	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.03	(384)
EI rating (section 14)				89.04	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-9-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.68	(1a) x	2.4	(2a) =	128.83	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.68	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	128.83	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: | 0 | (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) | 0 | (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 0 | (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.43	x1/[1/(1.4)+ 0.04]		=	3.22			(27)
Windows Type 2			4.04	x1/[1/(1.4)+ 0.04]		=	5.36			(27)
Windows Type 3			2.43	x1/[1/(1.4)+ 0.04]		=	3.22			(27)
Windows Type 4			2.43	x1/[1/(1.4)+ 0.04]		=	3.22			(27)
Walls Type1	35.36	11.33	24.03	x	0.18	=	4.33			(29)
Walls Type2	35.36	2.1	33.26	x	0.18	=	5.99			(29)
Roof	17.33	0	17.33	x	0.13	=	2.25			(30)
Total area of elements, m²			88.05							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) | (26)…(30) + (32) = | 29.69 | (33)

Heat capacity Cm = S(A x k) | ((28)…(30) + (32) + (32a)…(32e) = | 0 | (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K | Indicative Value: Medium | 250 | (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 8.63 | (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss | (33) + (36) = | 38.32 | (37)

Ventilation heat loss calculated monthly | (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.36	25.2	25.04	24.31	24.17	23.53	23.53	23.42	23.78	24.17	24.45	24.74	(38)

Heat transfer coefficient, W/K | (39)m = (37) + (38)m

(39)m=	63.67	63.52	63.36	62.63	62.49	61.85	61.85	61.73	62.1	62.49	62.77	63.06	

Average = Sum(39)$_{1…12}$ /12= | 62.63 | (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.19	1.18	1.18	1.17	1.16	1.15	1.15	1.15	1.16	1.16	1.17	1.17	

Average = Sum(40)1…12 /12= 1.17 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.8 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 76.92 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	84.61	81.53	78.45	75.38	72.3	69.22	69.22	72.3	75.38	78.45	81.53	84.61	
										Total = Sum(44)1…12 =		923	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	125.47	109.74	113.24	98.73	94.73	81.74	75.75	86.92	87.96	102.51	111.9	121.51	
										Total = Sum(45)1…12 =		1210.2	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.82	16.46	16.99	14.81	14.21	12.26	11.36	13.04	13.19	15.38	16.78	18.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	172.07	151.82	159.83	143.82	141.32	126.84	122.34	133.52	133.05	149.1	156.99	168.11	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	172.07	151.82	159.83	143.82	141.32	126.84	122.34	133.52	133.05	149.1	156.99	168.11	

Output from water heater (annual)$_{1...12}$ 1758.81 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	79	70.16	74.93	68.9	68.77	63.25	62.46	66.18	65.32	71.36	73.28	77.68	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.01	12.44	10.12	7.66	5.73	4.84	5.22	6.79	9.11	11.57	13.51	14.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	156.78	158.4	154.3	145.58	134.56	124.21	117.29	115.66	119.76	128.49	139.51	149.86	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	(71)

Water heating gains (Table 5)

(72)m=	106.18	104.4	100.71	95.69	92.44	87.85	83.95	88.95	90.72	95.91	101.78	104.41	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	329.94	328.23	318.11	301.91	285.7	269.87	259.45	264.38	272.58	288.95	307.77	321.65	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.43	x	10.63	x	0.63	x	0.7	=	7.9	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.63	x	0.7	=	7.9	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.63	x	0.7	=	15.09	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.63	x	0.7	=	15.09	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.63	x	0.7	=	25.64	(74)

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North	0.9x	0.77	x	2.43	x	34.53	x	0.63	x	0.7	=	25.64	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.63	x	0.7	=	41.19	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.63	x	0.7	=	41.19	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.63	x	0.7	=	55.49	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.63	x	0.7	=	55.49	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.63	x	0.7	=	59.4	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.63	x	0.7	=	59.4	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.63	x	0.7	=	55.46	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.63	x	0.7	=	55.46	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.63	x	0.7	=	44	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.63	x	0.7	=	44	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.63	x	0.7	=	30.83	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.63	x	0.7	=	30.83	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.63	x	0.7	=	17.96	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.63	x	0.7	=	17.96	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.63	x	0.7	=	9.74	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.63	x	0.7	=	9.74	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.63	x	0.7	=	6.58	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.63	x	0.7	=	6.58	(74)
East	0.9x	1	x	2.43	x	19.64	x	0.63	x	0.7	=	14.59	(76)
East	0.9x	1	x	4.04	x	19.64	x	0.63	x	0.7	=	24.25	(76)
East	0.9x	1	x	2.43	x	38.42	x	0.63	x	0.7	=	28.53	(76)
East	0.9x	1	x	4.04	x	38.42	x	0.63	x	0.7	=	47.44	(76)
East	0.9x	1	x	2.43	x	63.27	x	0.63	x	0.7	=	46.99	(76)
East	0.9x	1	x	4.04	x	63.27	x	0.63	x	0.7	=	78.12	(76)
East	0.9x	1	x	2.43	x	92.28	x	0.63	x	0.7	=	68.53	(76)
East	0.9x	1	x	4.04	x	92.28	x	0.63	x	0.7	=	113.94	(76)
East	0.9x	1	x	2.43	x	113.09	x	0.63	x	0.7	=	83.99	(76)
East	0.9x	1	x	4.04	x	113.09	x	0.63	x	0.7	=	139.63	(76)
East	0.9x	1	x	2.43	x	115.77	x	0.63	x	0.7	=	85.98	(76)
East	0.9x	1	x	4.04	x	115.77	x	0.63	x	0.7	=	142.94	(76)
East	0.9x	1	x	2.43	x	110.22	x	0.63	x	0.7	=	81.85	(76)
East	0.9x	1	x	4.04	x	110.22	x	0.63	x	0.7	=	136.08	(76)
East	0.9x	1	x	2.43	x	94.68	x	0.63	x	0.7	=	70.31	(76)
East	0.9x	1	x	4.04	x	94.68	x	0.63	x	0.7	=	116.89	(76)
East	0.9x	1	x	2.43	x	73.59	x	0.63	x	0.7	=	54.65	(76)
East	0.9x	1	x	4.04	x	73.59	x	0.63	x	0.7	=	90.86	(76)
East	0.9x	1	x	2.43	x	45.59	x	0.63	x	0.7	=	33.86	(76)
East	0.9x	1	x	4.04	x	45.59	x	0.63	x	0.7	=	56.29	(76)
East	0.9x	1	x	2.43	x	24.49	x	0.63	x	0.7	=	18.19	(76)
East	0.9x	1	x	4.04	x	24.49	x	0.63	x	0.7	=	30.24	(76)

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East	0.9x	1	x	2.43	x	16.15	x	0.63	x	0.7	=	11.99	(76)
East	0.9x	1	x	4.04	x	16.15	x	0.63	x	0.7	=	19.94	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	54.63	106.15	176.4	264.85	334.59	347.72	328.85	275.2	207.17	126.07	67.91	45.1	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	384.57	434.38	494.51	566.76	620.3	617.59	588.3	539.58	479.75	415.03	375.67	366.75	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.8	0.61	0.46	0.52	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.82	19.97	20.24	20.6	20.86	20.97	20.99	20.99	20.91	20.56	20.13	19.79	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.93	19.94	19.95	19.95	19.96	19.96	19.96	19.95	19.95	19.94	19.94	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.9	0.75	0.53	0.35	0.4	0.7	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.37	18.6	18.99	19.49	19.82	19.94	19.96	19.96	19.89	19.45	18.83	18.34	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.09	19.28	19.62	20.04	20.34	20.46	20.48	20.47	20.4	20.01	19.48	19.07	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.09	19.28	19.62	20.04	20.34	20.46	20.48	20.47	20.4	20.01	19.48	19.07	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.77	0.57	0.4	0.46	0.74	0.94	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	381.74	428.4	478.2	513.49	477.59	351.47	238.13	248.54	354.22	390.36	370.33	364.58	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	942	913.53	830.99	697.75	539.69	362.2	239.71	251.47	390.99	587.77	777.1	937.37	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	416.83	326.01	262.48	132.67	46.2	0	0	0	0	146.87	292.88	426.16	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 2050.09 (98)

Space heating requirement in kWh/m²/year 38.19 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	416.83	326.01	262.48	132.67	46.2	0	0	0	0	146.87	292.88	426.16		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	445.81	348.67	280.73	141.89	49.42	0	0	0	0	157.08	313.24	455.78		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2192.61	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	172.07	151.82	159.83	143.82	141.32	126.84	122.34	133.52	133.05	149.1	156.99	168.11		
Efficiency of water heater													79.8	(216)
(217)m=	87.09	86.8	86.13	84.6	82.19	79.8	79.8	79.8	79.8	84.77	86.45	87.19		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	197.58	174.91	185.58	170	171.94	158.94	153.31	167.31	166.73	175.88	181.58	192.8		
Total = Sum(219a)$_{1...12}$ =													2096.57	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2192.61	
Water heating fuel used			2096.57	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			247.43	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	473.6	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	452.86	(264)
Space and water heating	(261) + (262) + (263) + (264) =				926.46	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	128.41	(268)

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Total CO2, kg/year	sum of (265)…(271) =	1093.8	(272)
TER =		20.38	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.8

Property Address: b1-9-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.65	(1a) x	2.4	(2a) =	121.56	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.65	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.56	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	36.62	11.96	24.66	x	0.18	=	4.44			(29)
Walls Type2	25.07	2.1	22.97	x	0.18	=	4.13			(29)
Roof	21.11	0	21.11	x	0.11	=	2.32			(30)
Total area of elements, m²			82.8							(31)
Party wall			14.75	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 27.11 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 13.3 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 40.41 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	60.46	60.46	60.46	60.46	60.46	60.46	60.46	60.46	60.46	60.46	60.46	60.46	

Average = $Sum(39)_{1...12}$ /12= 60.46 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	

Average = $Sum(40)_{1...12}$ /12= 1.19 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.79 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	82.27	79.28	76.29	73.3	70.31	67.32	67.32	70.31	73.3	76.29	79.28	82.27

Total = $Sum(44)_{1...12}$ = 897.54 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.01	106.71	110.12	96	92.12	79.49	73.66	84.52	85.53	99.68	108.81	118.16

Total = $Sum(45)_{1...12}$ = 1176.81 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.3	16.01	16.52	14.4	13.82	11.92	11.05	12.68	12.83	14.95	16.32	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	177.29	156.64	165.39	149.5	147.39	132.98	128.94	139.8	139.03	154.96	162.3	173.44	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	177.29	156.64	165.39	149.5	147.39	132.98	128.94	139.8	139.03	154.96	162.3	173.44

Output from water heater (annual)$_{1...12}$ | 1827.65 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.79	75.42	80.84	74.72	74.85	69.23	68.71	72.33	71.23	77.37	78.97	83.51	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.28	11.79	9.59	7.26	5.43	4.58	4.95	6.44	8.64	10.97	12.8	13.65	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.92	150.47	146.57	138.28	127.82	117.98	111.41	109.87	113.76	122.05	132.52	142.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	(71)

Water heating gains (Table 5)

(72)m=	113.96	112.24	108.65	103.77	100.6	96.15	92.36	97.21	98.94	103.99	109.69	112.24	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	324.8	323.14	313.45	297.95	282.49	267.35	257.36	262.15	269.97	285.64	303.64	316.88	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)

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East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)

South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	113.51	195.48	270.93	337.99	378.11	374.49	361.47	332.12	294.49	217.19	136.4	96.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	438.31	518.61	584.38	635.94	660.6	641.84	618.83	594.27	564.46	502.83	440.04	413.71	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.88	0.76	0.58	0.43	0.46	0.69	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.94	20.14	20.41	20.69	20.89	20.97	21	20.99	20.94	20.68	20.25	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.85	0.7	0.49	0.32	0.36	0.6	0.87	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.55	18.83	19.21	19.58	19.82	19.91	19.92	19.92	19.89	19.59	18.99	18.47	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.24	19.49	19.81	20.13	20.35	20.44	20.46	20.46	20.42	20.14	19.62	19.18	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.24	19.49	19.81	20.13	20.35	20.44	20.46	20.46	20.42	20.14	19.62	19.18	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.97	0.93	0.86	0.72	0.54	0.38	0.41	0.64	0.88	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	431.6	501.85	544.73	544.39	476.48	344.36	232.11	243.42	361.47	443.15	426.41	408.74	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	903.53	882.06	804.66	679.31	523.27	353.25	233.36	245.36	381.89	576.6	756.84	905.56	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	351.12	255.5	193.39	97.14	34.81	0	0	0	0	99.29	237.91	369.64	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1638.79 | (98)

Space heating requirement in kWh/m²/year | 32.36 | (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1638.79	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1290.55	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	430.18	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1827.65	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1439.28	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	479.76	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	36.4	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		32.78	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	32.78	(331)
Energy for lighting (calculated in Appendix L)		234.47	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	3396.18	x	0.22	733.58	(363)

DER WorkSheet: New dwelling design stage

less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1086.78	x	0.52		-564.04	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	3787.57	x	0.22		818.11	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1212.02	x	0.52		-629.04	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	211.34	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	18.89	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	588.84	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					588.84	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	17.01	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	121.69	(379)
Total CO2, kg/year	sum of (376)…(382) =					727.54	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					14.36	(384)
EI rating (section 14)						89.81	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-9-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.65	(1a) x	2.4	(2a) =	121.56	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.65	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.56	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.06	x1/[1/(1.4)+ 0.04]		=	5.38			(27)
Windows Type 2			2.44	x1/[1/(1.4)+ 0.04]		=	3.23			(27)
Windows Type 3			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 4			2.44	x1/[1/(1.4)+ 0.04]		=	3.23			(27)
Walls Type1	36.62	10.56	26.06	x	0.18	=	4.69			(29)
Walls Type2	25.07	2.1	22.97	x	0.18	=	4.13			(29)
Roof	21.11	0	21.11	x	0.13	=	2.74			(30)
Total area of elements, m²			82.8							(31)
Party wall			14.75	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	27.67	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		8.75	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	36.42	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	24.11	23.95	23.79	23.07	22.94	22.3	22.3	22.19	22.55	22.94	23.21	23.5	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	60.52	60.37	60.21	59.49	59.35	58.72	58.72	58.61	58.97	59.35	59.63	59.91	

Average = Sum(39)$_{1...12}$ /12= 59.49 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.19	1.19	1.19	1.17	1.17	1.16	1.16	1.16	1.16	1.17	1.18	1.18	

Average = Sum(40)$_{1...12}$ /12= 1.17 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.79 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.27	79.28	76.29	73.3	70.31	67.32	67.32	70.31	73.3	76.29	79.28	82.27	

Total = Sum(44)$_{1...12}$ = 897.54 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.01	106.71	110.12	96	92.12	79.49	73.66	84.52	85.53	99.68	108.81	118.16	

Total = Sum(45)$_{1...12}$ = 1176.81 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.3	16.01	16.52	14.4	13.82	11.92	11.05	12.68	12.83	14.95	16.32	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.61	148.8	156.71	141.09	138.71	124.58	120.25	131.12	130.63	146.28	153.9	164.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.61	148.8	156.71	141.09	138.71	124.58	120.25	131.12	130.63	146.28	153.9	164.76	

Output from water heater (annual)$_{1...12}$	1725.43	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.84	69.15	73.89	67.99	67.9	62.5	61.77	65.38	64.51	70.42	72.25	76.56	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.32	11.83	9.62	7.28	5.44	4.6	4.97	6.46	8.67	11	12.84	13.69	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.92	150.47	146.57	138.28	127.82	117.98	111.41	109.87	113.76	122.05	132.52	142.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	(71)

Water heating gains (Table 5)

(72)m=	104.63	102.9	99.31	94.44	91.27	86.81	83.02	87.88	89.6	94.65	100.35	102.91	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.51	316.84	307.15	291.64	276.17	261.03	251.04	255.84	263.67	279.34	297.35	310.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.44	x	19.64	x	0.63	x	0.7	=	14.65	(76)
East	0.9x	1	x	2.44	x	19.64	x	0.63	x	0.7	=	14.65	(76)

East	0.9x	1	x	2.44	x	38.42	x	0.63	x	0.7	=	28.65	(76)
East	0.9x	1	x	2.44	x	38.42	x	0.63	x	0.7	=	28.65	(76)
East	0.9x	1	x	2.44	x	63.27	x	0.63	x	0.7	=	47.18	(76)
East	0.9x	1	x	2.44	x	63.27	x	0.63	x	0.7	=	47.18	(76)
East	0.9x	1	x	2.44	x	92.28	x	0.63	x	0.7	=	68.81	(76)
East	0.9x	1	x	2.44	x	92.28	x	0.63	x	0.7	=	68.81	(76)
East	0.9x	1	x	2.44	x	113.09	x	0.63	x	0.7	=	84.33	(76)
East	0.9x	1	x	2.44	x	113.09	x	0.63	x	0.7	=	84.33	(76)
East	0.9x	1	x	2.44	x	115.77	x	0.63	x	0.7	=	86.33	(76)
East	0.9x	1	x	2.44	x	115.77	x	0.63	x	0.7	=	86.33	(76)
East	0.9x	1	x	2.44	x	110.22	x	0.63	x	0.7	=	82.19	(76)
East	0.9x	1	x	2.44	x	110.22	x	0.63	x	0.7	=	82.19	(76)
East	0.9x	1	x	2.44	x	94.68	x	0.63	x	0.7	=	70.6	(76)
East	0.9x	1	x	2.44	x	94.68	x	0.63	x	0.7	=	70.6	(76)
East	0.9x	1	x	2.44	x	73.59	x	0.63	x	0.7	=	54.88	(76)
East	0.9x	1	x	2.44	x	73.59	x	0.63	x	0.7	=	54.88	(76)
East	0.9x	1	x	2.44	x	45.59	x	0.63	x	0.7	=	34	(76)
East	0.9x	1	x	2.44	x	45.59	x	0.63	x	0.7	=	34	(76)
East	0.9x	1	x	2.44	x	24.49	x	0.63	x	0.7	=	18.26	(76)
East	0.9x	1	x	2.44	x	24.49	x	0.63	x	0.7	=	18.26	(76)
East	0.9x	1	x	2.44	x	16.15	x	0.63	x	0.7	=	12.04	(76)
East	0.9x	1	x	2.44	x	16.15	x	0.63	x	0.7	=	12.04	(76)
South	0.9x	0.77	x	4.06	x	46.75	x	0.63	x	0.7	=	58.01	(78)
South	0.9x	0.77	x	1.62	x	46.75	x	0.63	x	0.7	=	23.15	(78)
South	0.9x	0.77	x	4.06	x	76.57	x	0.63	x	0.7	=	95	(78)
South	0.9x	0.77	x	1.62	x	76.57	x	0.63	x	0.7	=	37.91	(78)
South	0.9x	0.77	x	4.06	x	97.53	x	0.63	x	0.7	=	121.02	(78)
South	0.9x	0.77	x	1.62	x	97.53	x	0.63	x	0.7	=	48.29	(78)
South	0.9x	0.77	x	4.06	x	110.23	x	0.63	x	0.7	=	136.78	(78)
South	0.9x	0.77	x	1.62	x	110.23	x	0.63	x	0.7	=	54.58	(78)
South	0.9x	0.77	x	4.06	x	114.87	x	0.63	x	0.7	=	142.53	(78)
South	0.9x	0.77	x	1.62	x	114.87	x	0.63	x	0.7	=	56.87	(78)
South	0.9x	0.77	x	4.06	x	110.55	x	0.63	x	0.7	=	137.17	(78)
South	0.9x	0.77	x	1.62	x	110.55	x	0.63	x	0.7	=	54.73	(78)
South	0.9x	0.77	x	4.06	x	108.01	x	0.63	x	0.7	=	134.02	(78)
South	0.9x	0.77	x	1.62	x	108.01	x	0.63	x	0.7	=	53.48	(78)
South	0.9x	0.77	x	4.06	x	104.89	x	0.63	x	0.7	=	130.15	(78)
South	0.9x	0.77	x	1.62	x	104.89	x	0.63	x	0.7	=	51.93	(78)
South	0.9x	0.77	x	4.06	x	101.89	x	0.63	x	0.7	=	126.42	(78)
South	0.9x	0.77	x	1.62	x	101.89	x	0.63	x	0.7	=	50.44	(78)
South	0.9x	0.77	x	4.06	x	82.59	x	0.63	x	0.7	=	102.47	(78)

South	0.9x	0.77	x	1.62	x	82.59	x	0.63	x	0.7	=	40.89	(78)
South	0.9x	0.77	x	4.06	x	55.42	x	0.63	x	0.7	=	68.76	(78)
South	0.9x	0.77	x	1.62	x	55.42	x	0.63	x	0.7	=	27.44	(78)
South	0.9x	0.77	x	4.06	x	40.4	x	0.63	x	0.7	=	50.13	(78)
South	0.9x	0.77	x	1.62	x	40.4	x	0.63	x	0.7	=	20	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	110.45	190.21	263.67	328.98	368.07	364.56	351.87	323.28	286.61	211.35	132.72	94.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	428.96	507.05	570.82	620.62	644.24	625.59	602.91	579.12	550.28	490.69	430.07	404.8	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.89	0.76	0.58	0.42	0.46	0.69	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.92	20.13	20.39	20.69	20.89	20.98	21	20.99	20.95	20.69	20.25	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.92	19.93	19.93	19.94	19.94	19.95	19.95	19.95	19.95	19.94	19.94	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.94	0.85	0.7	0.49	0.33	0.36	0.6	0.88	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.52	18.81	19.19	19.6	19.84	19.94	19.95	19.95	19.91	19.61	19	18.47	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.22	19.47	19.79	20.14	20.36	20.46	20.47	20.47	20.43	20.15	19.63	19.18	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.22	19.47	19.79	20.14	20.36	20.46	20.47	20.47	20.43	20.15	19.63	19.18	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.86	0.73	0.54	0.38	0.41	0.64	0.89	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	422.9	491.88	534.58	534.49	468.22	335.97	226.39	237.05	353.97	434.64	417.61	400.32	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	903.09	879.49	800.46	668.84	514.27	344.01	227.48	238.73	373.27	566.69	746.86	897.46	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	357.26	260.47	197.82	96.73	34.26	0	0	0	0	98.24	237.06	369.87	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1651.72 (98)

Space heating requirement in kWh/m²/year 32.61 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	357.26	260.47	197.82	96.73	34.26	0	0	0	0	98.24	237.06	369.87		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	382.1	278.58	211.57	103.46	36.64	0	0	0	0	105.07	253.54	395.59		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1766.54	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	168.61	148.8	156.71	141.09	138.71	124.58	120.25	131.12	130.63	146.28	153.9	164.76		
Efficiency of water heater													79.8	(216)
(217)m=	86.77	86.29	85.44	83.83	81.71	79.8	79.8	79.8	79.8	83.78	85.96	86.91		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	194.31	172.43	183.42	168.31	169.75	156.12	150.69	164.31	163.69	174.6	179.03	189.57		
Total = Sum(219a)$_{1...12}$ =													2066.24	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1766.54	
Water heating fuel used			2066.24	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			235.23	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	381.57	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	446.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				827.88	(265)

TER WorkSheet: New dwelling design stage

Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	122.09	(268)
Total CO2, kg/year			sum of (265)…(271) =		988.89	(272)

TER =	19.52	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version: Version: 1.0.4.8

Property Address: b1-9-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	101.62	(1a) x	2.4	(2a) =	243.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	101.62	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	243.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Walls Type1	49.24	18.86	30.38	x	0.18	=	5.47			(29)
Walls Type2	14.73	2.1	12.63	x	0.18	=	2.27			(29)
Roof	31.96	0	31.96	x	0.11	=	3.52			(30)
Total area of elements, m²			95.93							(31)
Party wall			34.51	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	35.37	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		15.94	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	51.31	(37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.24	40.24	40.24	40.24	40.24	40.24	40.24	40.24	40.24	40.24	40.24	40.24	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	91.55	91.55	91.55	91.55	91.55	91.55	91.55	91.55	91.55	91.55	91.55	91.55		

Average = Sum(39)$_{1…12}$ /12= 91.55 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9

Average = Sum(40)$_{1…12}$ /12= 0.9 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.75 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.61 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.57	105.58	101.6	97.62	93.63	89.65	89.65	93.63	97.62	101.6	105.58	109.57	

Total = Sum(44)$_{1…12}$ = 1195.3 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	162.49	142.11	146.65	127.85	122.68	105.86	98.09	112.57	113.91	132.75	144.91	157.36

Total = Sum(45)$_{1…12}$ = 1567.22 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.37	21.32	22	19.18	18.4	15.88	14.71	16.88	17.09	19.91	21.74	23.6	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	217.76	192.04	201.92	181.34	177.95	159.35	153.37	167.84	167.4	188.03	198.4	212.64	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	217.76	192.04	201.92	181.34	177.95	159.35	153.37	167.84	167.4	188.03	198.4	212.64

Output from water heater (annual)$_{1...12}$ — 2218.06 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	98.25	87.19	92.98	85.31	85.01	77.99	76.84	81.65	80.67	88.36	90.98	96.54	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	23.13	20.54	16.71	12.65	9.46	7.98	8.63	11.21	15.05	19.11	22.3	23.77	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	258.92	261.61	254.84	240.42	222.23	205.13	193.7	191.02	197.79	212.2	230.4	247.5	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	(71)

Water heating gains (Table 5)

(72)m=	132.05	129.75	124.98	118.48	114.26	108.32	103.28	109.74	112.04	118.76	126.36	129.76	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	478.42	476.22	460.83	435.86	410.26	385.74	369.92	376.28	389.19	414.38	443.36	465.34	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	5.29	x	46.75	x	0.5	x	0.8	=	68.56	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	5.29	x	76.57	x	0.5	x	0.8	=	112.28	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	5.29	x	97.53	x	0.5	x	0.8	=	143.02	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	5.29	x	110.23	x	0.5	x	0.8	=	161.65	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	5.29	x	114.87	x	0.5	x	0.8	=	168.45	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	5.29	x	110.55	x	0.5	x	0.8	=	162.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	5.29	x	108.01	x	0.5	x	0.8	=	158.39	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	5.29	x	104.89	x	0.5	x	0.8	=	153.82	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	5.29	x	101.89	x	0.5	x	0.8	=	149.4	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	5.29	x	82.59	x	0.5	x	0.8	=	121.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	5.29	x	55.42	x	0.5	x	0.8	=	81.26	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	5.29	x	40.4	x	0.5	x	0.8	=	59.24	(78)
West	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(80)

West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	183.92	315.17	433.45	536.24	596.58	589.6	569.61	525.59	469.52	349.2	220.71	157.09	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	662.34	791.39	894.29	972.1	1006.83	975.34	939.52	901.87	858.7	763.58	664.07	622.44	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.91	0.78	0.59	0.43	0.46	0.7	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.33	20.55	20.78	20.93	20.99	21	21	20.97	20.77	20.41	20.11	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.88	0.73	0.52	0.35	0.38	0.63	0.91	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.29	19.61	19.92	20.11	20.16	20.17	20.17	20.15	19.91	19.4	18.97	(90)

fLA = Living area ÷ (4) = | 0.3 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.38	19.6	19.89	20.18	20.36	20.41	20.42	20.42	20.39	20.17	19.7	19.32	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.38	19.6	19.89	20.18	20.36	20.41	20.42	20.42	20.39	20.17	19.7	19.32	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.88	0.74	0.54	0.37	0.41	0.65	0.91	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	658.52	778.59	855.32	859.88	745.02	525.91	348.85	366.74	558.86	696.11	654.39	619.89	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1380.31	1346.13	1226.15	1032.77	792.38	531.83	349.36	367.62	576.25	876.06	1153.71	1383.82	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	537.01	381.39	275.9	124.48	35.23	0	0	0	0	133.88	359.51	568.36	

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2415.76	(98)
Space heating requirement in kWh/m²/year		23.77	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2415.76	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1902.41	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	634.14	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2218.06	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1746.72	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	582.24	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	48.66	(313)

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Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		65.76	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	65.76	(331)
Energy for lighting (calculated in Appendix L)		408.5	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	5006.35	x	0.22		1081.37	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1602.03	x	0.52		-831.45	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4596.64	x	0.22		992.88	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1470.93	x	0.52		-763.41	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	282.51	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	25.25	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	787.15	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					787.15	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	34.13	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	212.01	(379)
Total CO2, kg/year	sum of (376)…(382) =					1033.29	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					10.17	(384)
EI rating (section 14)						90.56	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-9-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	101.62	(1a) x	2.4	(2a) =	243.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	101.62	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	243.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 5			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Walls Type1	49.24	18.86	30.38	x	0.18	=	5.47			(29)
Walls Type2	14.73	2.1	12.63	x	0.18	=	2.27			(29)
Roof	31.96	0	31.96	x	0.13	=	4.15			(30)
Total area of elements, m²			95.93							(31)
Party wall			34.51	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	39	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		10.03	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	49.03	(37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	48.34	48.03	47.72	46.27	46	44.74	44.74	44.51	45.23	46	46.55	47.12	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	97.37	97.06	96.75	95.3	95.03	93.77	93.77	93.53	94.25	95.03	95.58	96.15	

Average = Sum(39)$_{1\ldots12}$ /12= 95.3 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.96	0.96	0.95	0.94	0.94	0.92	0.92	0.92	0.93	0.94	0.94	0.95	

Average = Sum(40)$_{1\ldots12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.75 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.61 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	109.57	105.58	101.6	97.62	93.63	89.65	89.65	93.63	97.62	101.6	105.58	109.57	

Total = Sum(44)$_{1\ldots12}$ = 1195.3 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	162.49	142.11	146.65	127.85	122.68	105.86	98.09	112.57	113.91	132.75	144.91	157.36	

Total = Sum(45)$_{1\ldots12}$ = 1567.22 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.37	21.32	22	19.18	18.4	15.88	14.71	16.88	17.09	19.91	21.74	23.6	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	209.08	184.2	193.24	172.94	169.27	150.95	144.69	159.16	159	179.35	190	203.96	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	209.08	184.2	193.24	172.94	169.27	150.95	144.69	159.16	159	179.35	190	203.96

Output from water heater (annual) $_{1\ldots12}$ — 2115.84 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.3	80.92	86.04	78.58	78.07	71.27	69.89	74.7	73.95	81.42	84.26	89.6	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	23.47	20.84	16.95	12.83	9.59	8.1	8.75	11.37	15.27	19.38	22.62	24.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	258.92	261.61	254.84	240.42	222.23	205.13	193.7	191.02	197.79	212.2	230.4	247.5	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	(71)

Water heating gains (Table 5)

(72)m=	122.72	120.42	115.64	109.14	104.93	98.99	93.94	100.41	102.71	109.43	117.02	120.43	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	472.42	470.18	454.74	429.71	404.06	379.52	363.71	370.11	383.07	408.32	437.35	459.35	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	5.29	x	46.75	x	0.63	x	0.7	=	75.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	5.29	x	76.57	x	0.63	x	0.7	=	123.79	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	5.29	x	97.53	x	0.63	x	0.7	=	157.68	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	5.29	x	110.23	x	0.63	x	0.7	=	178.22	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	5.29	x	114.87	x	0.63	x	0.7	=	185.71	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	5.29	x	110.55	x	0.63	x	0.7	=	178.72	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	5.29	x	108.01	x	0.63	x	0.7	=	174.62	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	5.29	x	104.89	x	0.63	x	0.7	=	169.58	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	5.29	x	101.89	x	0.63	x	0.7	=	164.72	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	5.29	x	82.59	x	0.63	x	0.7	=	133.52	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	5.29	x	55.42	x	0.63	x	0.7	=	89.59	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	5.29	x	40.4	x	0.63	x	0.7	=	65.31	(78)
West	0.9x	0.77	x	5.29	x	19.64	x	0.63	x	0.7	=	31.75	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.63	x	0.7	=	62.11	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.63	x	0.7	=	102.29	(80)

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West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.63	x	0.7	=	149.19	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.63	x	0.7	=	182.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.63	x	0.7	=	187.17	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.63	x	0.7	=	178.19	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.63	x	0.7	=	153.06	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.63	x	0.7	=	118.97	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.63	x	0.7	=	73.7	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.63	x	0.7	=	39.59	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.63	x	0.7	=	26.11	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	202.77	347.48	477.88	591.2	657.73	650.03	627.99	579.46	517.64	384.99	243.33	173.2	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	675.19	817.65	932.62	1020.91	1061.78	1029.56	991.7	949.57	900.71	793.32	680.68	632.55	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.77	0.57	0.41	0.45	0.69	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.28	20.52	20.78	20.93	20.99	21	21	20.97	20.76	20.37	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.12	20.12	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.13	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.88	0.71	0.5	0.34	0.37	0.62	0.91	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.9	19.18	19.53	19.89	20.08	20.14	20.15	20.15	20.12	19.87	19.33	18.86	(90)

fLA = Living area ÷ (4) = | 0.3 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.26	19.51	19.82	20.15	20.33	20.4	20.4	20.4	20.38	20.14	19.64	19.22	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.26	19.51	19.82	20.15	20.33	20.4	20.4	20.4	20.38	20.14	19.64	19.22	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.88	0.73	0.52	0.36	0.39	0.64	0.91	0.98	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	671.07	803.48	889.26	894.36	772.24	537.98	356.12	373.68	574.49	719.21	670.16	629.8	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1456.33	1417.84	1289.14	1072.45	820.49	543.54	356.61	374.51	591.8	906.57	1198.48	1444.16	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	584.23	412.85	297.5	128.23	35.9	0	0	0	0	139.39	380.39	605.88	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2584.38 (98)

Space heating requirement in kWh/m²/year 25.43 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	584.23	412.85	297.5	128.23	35.9	0	0	0	0	139.39	380.39	605.88		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	624.85	441.55	318.19	137.14	38.39	0	0	0	0	149.08	406.84	648		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2764.04	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	209.08	184.2	193.24	172.94	169.27	150.95	144.69	159.16	159	179.35	190	203.96		
Efficiency of water heater													79.8	(216)
(217)m=	87.41	86.9	85.96	84.03	81.49	79.8	79.8	79.8	79.8	84.15	86.63	87.54		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	239.19	211.95	224.8	205.81	207.73	189.16	181.32	199.45	199.25	213.12	219.32	232.98		
Total = Sum(219a)$_{1...12}$ =													2524.09	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2764.04

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Water heating fuel used			2524.09	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			414.41	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	597.03	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	545.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1142.24	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	215.08	(268)
Total CO2, kg/year		sum of (265)…(271) =		1396.24	(272)
TER =				13.74	(273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b1-9-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	104.77	(1a) x	2.4	(2a) =	251.45	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	104.77	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	251.45	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84		x1/[1/(1.2)+ 0.04]	=	2.11			(27)
Windows Type 2			2.76		x1/[1/(1.2)+ 0.04]	=	3.16			(27)
Windows Type 3			1.84		x1/[1/(1.2)+ 0.04]	=	2.11			(27)
Windows Type 4			1.84		x1/[1/(1.2)+ 0.04]	=	2.11			(27)
Windows Type 5			1.84		x1/[1/(1.2)+ 0.04]	=	2.11			(27)
Windows Type 6			9.06		x1/[1/(1.2)+ 0.04]	=	10.37			(27)
Windows Type 7			2.76		x1/[1/(1.2)+ 0.04]	=	3.16			(27)
Walls Type1	50.36	21.94	28.42	x	0.18	=	5.12			(29)
Walls Type2	31.52	2.1	29.42	x	0.18	=	5.3			(29)
Roof	28.91	0	28.91	x	0.11	=	3.18			(30)
Total area of elements, m²			110.79							(31)
Party wall			18.84	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 41.23 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 20.39 (36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 61.62 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.49	41.49	41.49	41.49	41.49	41.49	41.49	41.49	41.49	41.49	41.49	41.49	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	103.11	103.11	103.11	103.11	103.11	103.11	103.11	103.11	103.11	103.11	103.11	103.11

Average = Sum(39)$_{1\ldots12}$ /12= 103.11 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98

Average = Sum(40)$_{1\ldots12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.78 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 100.21 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	110.23	106.23	102.22	98.21	94.2	90.19	90.19	94.2	98.21	102.22	106.23	110.23	

Total = Sum(44)$_{1\ldots12}$ = 1202.56 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	163.47	142.98	147.54	128.63	123.42	106.5	98.69	113.25	114.6	133.56	145.79	158.32

Total = Sum(45)$_{1\ldots12}$ = 1576.75 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.52	21.45	22.13	19.29	18.51	15.98	14.8	16.99	17.19	20.03	21.87	23.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	218.75	192.9	202.82	182.12	178.7	160	153.97	168.53	168.1	188.83	199.28	213.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	218.75	192.9	202.82	182.12	178.7	160	153.97	168.53	168.1	188.83	199.28	213.59	

Output from water heater (annual) 1…12 | 2227.59 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	98.58	87.48	93.28	85.56	85.26	78.21	77.04	81.88	80.9	88.63	91.27	96.86	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	23.52	20.89	16.99	12.86	9.61	8.12	8.77	11.4	15.3	19.43	22.68	24.17	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	263.82	266.55	259.66	244.97	226.43	209.01	197.37	194.63	201.53	216.21	234.75	252.18	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	(71)

Water heating gains (Table 5)

(72)m=	132.5	130.18	125.37	118.84	114.6	108.62	103.54	110.05	112.36	119.13	126.76	130.19	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	484.52	482.32	466.71	441.36	415.33	390.44	374.37	380.77	393.88	419.46	448.88	471.23	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	9.06	x	10.63	x	0.5	x	0.8	=	26.71	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	9.06	x	20.32	x	0.5	x	0.8	=	51.03	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	9.06	x	34.53	x	0.5	x	0.8	=	86.72	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	9.06	x	55.46	x	0.5	x	0.8	=	139.3	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	9.06	x	74.72	x	0.5	x	0.8	=	187.64	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	9.06	x	79.99	x	0.5	x	0.8	=	200.88	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	9.06	x	74.68	x	0.5	x	0.8	=	187.55	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	9.06	x	59.25	x	0.5	x	0.8	=	148.79	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	9.06	x	41.52	x	0.5	x	0.8	=	104.27	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	9.06	x	24.19	x	0.5	x	0.8	=	60.75	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	9.06	x	13.12	x	0.5	x	0.8	=	32.94	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	9.06	x	8.86	x	0.5	x	0.8	=	22.26	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)

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West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)

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West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	89.94	174.36	290.64	440.6	562.06	586.84	553.87	459.71	342.47	207.15	111.68	74.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	574.46	656.68	757.35	881.96	977.39	977.28	928.24	840.48	736.35	626.61	560.56	545.59	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) — 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.84	0.65	0.48	0.55	0.84	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.94	20.07	20.31	20.63	20.87	20.98	21	20.99	20.91	20.58	20.19	19.9	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.94	0.79	0.57	0.39	0.45	0.77	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.67	18.86	19.21	19.66	19.98	20.08	20.1	20.09	20.02	19.59	19.04	18.62	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.05	19.22	19.54	19.95	20.25	20.35	20.37	20.36	20.29	19.89	19.38	19	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.05	19.22	19.54	19.95	20.25	20.35	20.37	20.36	20.29	19.89	19.38	19	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.8	0.59	0.42	0.48	0.78	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	573.07	653.08	744.56	825.52	785.26	578.95	386.7	405.18	577.28	606.15	557.56	544.59	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1520.79	1476.92	1344.56	1138.97	881.15	592.93	388.27	408.64	638.33	957.77	1266.64	1526.18	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	705.1	553.62	446.4	225.68	71.35	0	0	0	0	261.6	510.53	730.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3504.58 (98)

Space heating requirement in kWh/m²/year — 33.45 (99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		3504.58	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	2759.86	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	919.95	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2227.59	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1754.23	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	584.74	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	60.19	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		67.8	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	67.8	(331)
Energy for lighting (calculated in Appendix L)		415.36	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	7262.79	x	0.22	1568.76	(363)

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less credit emissions for electricity	–(307a) × (361) ÷ (362) =	2324.09	x	0.52		-1206.2	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4616.38	x	0.22		997.14	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1477.24	x	0.52		-766.69	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	349.48	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	31.24	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	973.72	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					973.72	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	35.19	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	215.57	(379)
Total CO2, kg/year	sum of (376)…(382) =					1224.48	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					11.69	(384)
EI rating (section 14)						89.04	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b1-9-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	104.77	(1a) x	2.4	(2a) =	251.45	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	104.77	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	251.45	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.43	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 4			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 5			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 6			9.06	x1/[1/(1.4)+ 0.04]		=	12.01			(27)
Windows Type 7			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	50.36	21.94	28.42	x	0.18	=	5.12			(29)
Walls Type2	31.52	2.1	29.42	x	0.18	=	5.3			(29)
Roof	28.91	0	28.91	x	0.13	=	3.76			(30)
Total area of elements, m²			110.79							(31)
Party wall			18.84	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	45.36	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	11.64	(36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 57 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	49.64	49.33	49.02	47.56	47.29	46.02	46.02	45.78	46.51	47.29	47.84	48.41	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	106.64	106.33	106.02	104.56	104.29	103.02	103.02	102.78	103.5	104.29	104.84	105.41	

Average = $Sum(39)_{1...12}$ /12= 104.56 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.02	1.01	1.01	1	1	0.98	0.98	0.98	0.99	1	1	1.01	

Average = $Sum(40)_{1...12}$ /12= 1 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.78 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 100.21 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	110.23	106.23	102.22	98.21	94.2	90.19	90.19	94.2	98.21	102.22	106.23	110.23	

Total = $Sum(44)_{1...12}$ = 1202.56 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	163.47	142.98	147.54	128.63	123.42	106.5	98.69	113.25	114.6	133.56	145.79	158.32	

Total = $Sum(45)_{1...12}$ = 1576.75 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.52	21.45	22.13	19.29	18.51	15.98	14.8	16.99	17.19	20.03	21.87	23.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.07	185.06	194.13	173.72	170.02	151.6	145.29	159.84	159.69	180.15	190.88	204.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	210.07	185.06	194.13	173.72	170.02	151.6	145.29	159.84	159.69	180.15	190.88	204.91	

Output from water heater (annual)1…12 | 2125.36 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.63	81.21	86.33	78.84	78.31	71.49	70.09	74.93	74.18	81.68	84.55	89.92	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	23.59	20.95	17.04	12.9	9.64	8.14	8.8	11.43	15.35	19.49	22.74	24.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	263.82	266.55	259.66	244.97	226.43	209.01	197.37	194.63	201.53	216.21	234.75	252.18	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	(71)

Water heating gains (Table 5)

(72)m=	123.16	120.85	116.04	109.5	105.26	99.29	94.21	100.71	103.03	109.79	117.43	120.86	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	478.26	476.04	460.43	435.06	409.03	384.13	368.06	374.47	387.59	413.18	442.62	464.97	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	9.06	x	10.63	x	0.63	x	0.7	=	29.44	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.63	x	0.7	=	8.97	(74)
North	0.9x	0.77	x	9.06	x	20.32	x	0.63	x	0.7	=	56.27	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.63	x	0.7	=	17.14	(74)
North	0.9x	0.77	x	9.06	x	34.53	x	0.63	x	0.7	=	95.61	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	9.06	x	55.46	x	0.63	x	0.7	=	153.57	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.63	x	0.7	=	46.78	(74)
North	0.9x	0.77	x	9.06	x	74.72	x	0.63	x	0.7	=	206.88	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.63	x	0.7	=	63.02	(74)
North	0.9x	0.77	x	9.06	x	79.99	x	0.63	x	0.7	=	221.47	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.63	x	0.7	=	67.47	(74)
North	0.9x	0.77	x	9.06	x	74.68	x	0.63	x	0.7	=	206.77	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.63	x	0.7	=	62.99	(74)
North	0.9x	0.77	x	9.06	x	59.25	x	0.63	x	0.7	=	164.04	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.63	x	0.7	=	49.97	(74)
North	0.9x	0.77	x	9.06	x	41.52	x	0.63	x	0.7	=	114.95	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.63	x	0.7	=	35.02	(74)
North	0.9x	0.77	x	9.06	x	24.19	x	0.63	x	0.7	=	66.98	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.63	x	0.7	=	20.4	(74)
North	0.9x	0.77	x	9.06	x	13.12	x	0.63	x	0.7	=	36.32	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.63	x	0.7	=	11.06	(74)
North	0.9x	0.77	x	9.06	x	8.86	x	0.63	x	0.7	=	24.54	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.63	x	0.7	=	7.48	(74)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)

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West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)

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West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	99.15	192.23	320.43	485.76	619.67	646.99	610.64	506.83	377.57	228.38	123.13	81.97	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	577.41	668.28	780.85	920.83	1028.7	1031.12	978.7	881.3	765.16	641.56	565.74	546.94	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.82	0.62	0.46	0.53	0.82	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.89	20.04	20.3	20.64	20.89	20.98	21	20.99	20.92	20.58	20.18	19.87	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.07	20.07	20.07	20.09	20.09	20.1	20.1	20.1	20.09	20.09	20.08	20.08	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.98	0.93	0.77	0.54	0.37	0.43	0.75	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.58	18.8	19.17	19.66	19.98	20.09	20.1	20.1	20.03	19.59	19.01	18.56	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.98	19.17	19.51	19.96	20.25	20.35	20.37	20.37	20.3	19.89	19.36	18.95	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.98	19.17	19.51	19.96	20.25	20.35	20.37	20.37	20.3	19.89	19.36	18.95	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.78	0.56	0.4	0.46	0.77	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	575.97	664.35	766.3	854.14	805.48	581.86	386.82	404.95	586.46	618.97	562.59	545.92	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1565.02	1517.11	1379.11	1155.96	891.85	592.82	388.01	407.63	641.37	968.41	1285.03	1555.12	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	735.86	573.06	455.93	217.31	64.27	0	0	0	0	259.99	520.16	750.84	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3577.4 (98)

Space heating requirement in kWh/m²/year 34.15 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	735.86	573.06	455.93	217.31	64.27	0	0	0	0	259.99	520.16	750.84		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	787.01	612.89	487.63	232.42	68.73	0	0	0	0	278.06	556.32	803.04		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													3826.1	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	210.07	185.06	194.13	173.72	170.02	151.6	145.29	159.84	159.69	180.15	190.88	204.91		
Efficiency of water heater													79.8	(216)
(217)m=	87.88	87.63	87.02	85.41	82.47	79.8	79.8	79.8	79.8	85.79	87.36	87.97		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	239.03	211.18	223.1	203.39	206.14	189.97	182.06	200.31	200.12	209.99	218.51	232.93		
Total = Sum(219a)$_{1...12}$ =													2516.73	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3826.1	
Water heating fuel used			2516.73	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			416.58	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	826.44	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	543.61	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1370.05	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	216.21	(268)
Total CO2, kg/year		sum of (265)…(271) =		1625.18	(272)

TER =	15.51	(273)

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User Details:

Assessor Name: **Stroma Number:**
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.8

Property Address: b2-10-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.09	(1a) x	2.4	(2a) =	177.82	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.09	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	177.82	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76		x1/[1/(1.2)+ 0.04]	=	3.16			(27)
Windows Type 2			2.76		x1/[1/(1.2)+ 0.04]	=	3.16			(27)
Windows Type 3			2.76		x1/[1/(1.2)+ 0.04]	=	3.16			(27)
Windows Type 4			4.6		x1/[1/(1.2)+ 0.04]	=	5.27			(27)
Walls Type1	31	12.88	18.12	x	0.18	=	3.26			(29)
Walls Type2	31.26	2.1	29.16	x	0.18	=	5.25			(29)
Roof	19.99	0	19.99	x	0.11	=	2.2			(30)
Total area of elements, m²			82.25							(31)
Party wall			31.88	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 27.98 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.16 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 43.13 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	72.47	72.47	72.47	72.47	72.47	72.47	72.47	72.47	72.47	72.47	72.47	72.47

Average = Sum(39)$_{1\ldots12}$ /12= 72.47 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98

Average = Sum(40)$_{1\ldots12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.34 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.8 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	98.78	95.19	91.6	88.01	84.42	80.82	80.82	84.42	88.01	91.6	95.19	98.78

Total = Sum(44)$_{1\ldots12}$ = 1077.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.49	128.12	132.21	115.27	110.6	95.44	88.44	101.49	102.7	119.68	130.64	141.87

Total = Sum(45)$_{1\ldots12}$ = 1412.96 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.97	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.4	17.95	19.6	21.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.77	178.05	187.49	168.76	165.88	148.93	143.72	156.76	156.19	174.96	184.14	197.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.77	178.05	187.49	168.76	165.88	148.93	143.72	156.76	156.19	174.96	184.14	197.15

Output from water heater (annual)$_{1...12}$ | 2063.8 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.93	82.54	88.18	81.12	81	74.53	73.63	77.97	76.94	84.02	86.23	91.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.57	16.49	13.41	10.15	7.59	6.41	6.92	9	12.08	15.34	17.9	19.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	206.65	208.79	203.39	191.89	177.36	163.72	154.6	152.45	157.86	169.36	183.88	197.53	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	(71)

Water heating gains (Table 5)

(72)m=	124.91	122.83	118.52	112.67	108.87	103.51	98.96	104.79	106.86	112.93	119.77	122.84	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	408.24	406.23	393.44	372.82	351.94	331.75	318.6	324.36	334.92	355.74	379.67	397.57	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.6	x	10.63	x	0.5	x	0.8	=	13.56	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.5	x	0.8	=	25.91	(74)

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North	0.9x	0.77	x	4.6	x	34.53	x	0.5	x	0.8	=	44.03	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.5	x	0.8	=	70.72	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.5	x	0.8	=	95.27	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.5	x	0.8	=	101.99	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.5	x	0.8	=	95.22	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.5	x	0.8	=	75.55	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.5	x	0.8	=	52.94	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.5	x	0.8	=	30.84	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.5	x	0.8	=	16.73	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.5	x	0.8	=	11.3	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)

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East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	58.64	114.1	189.26	282.53	354.84	367.71	348.2	292.85	221.84	135.48	72.93	48.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	466.88	520.33	582.7	655.35	706.78	699.46	666.8	617.21	556.76	491.22	452.6	445.95	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.83	0.64	0.47	0.53	0.8	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.03	20.15	20.38	20.66	20.89	20.98	21	20.99	20.93	20.64	20.27	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.78	0.56	0.38	0.43	0.73	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.8	18.98	19.31	19.71	19.99	20.09	20.1	20.1	20.05	19.68	19.16	18.75	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.29	19.45	19.73	20.09	20.35	20.44	20.46	20.46	20.4	20.06	19.6	19.24	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.29	19.45	19.73	20.09	20.35	20.44	20.46	20.46	20.4	20.06	19.6	19.24	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.8	0.59	0.42	0.47	0.76	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	464.77	515.69	569.09	606.69	562.61	413.82	278.55	291.82	420.84	468.21	448.33	444.37	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1086.32	1054.35	959.1	811	626.91	423.58	279.67	294.03	456.59	685.77	906.06	1090.2	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	462.44	361.98	290.17	147.1	47.84	0	0	0	0	161.86	329.57	480.49	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2281.46 (98)

Space heating requirement in kWh/m²/year 30.79 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2281.46	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1796.65	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	598.88	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2063.8	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1625.24	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	541.75	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	45.63	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.94	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	47.94	(331)
Energy for lighting (calculated in Appendix L)		327.88	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4728.03	x	0.22	1021.25	(363)

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less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1512.97	x	0.52		-785.23	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4276.95	x	0.22		923.82	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1368.62	x	0.52		-710.32	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	264.92	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	23.68	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	738.13	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					738.13	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	24.88	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	170.17	(379)
Total CO2, kg/year	sum of (376)…(382) =					933.18	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					12.6	(384)
EI rating (section 14)						89.5	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-10-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.09	(1a) x	2.4	(2a) =	177.82	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.09	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	177.82	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Walls Type1	31	12.88	18.12	x	0.18	=	3.26			(29)
Walls Type2	31.26	2.1	29.16	x	0.18	=	5.25			(29)
Roof	19.99	0	19.99	x	0.13	=	2.6			(30)
Total area of elements, m²			82.25							(31)
Party wall			31.88	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.9 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 43.19 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	35.38	35.15	34.92	33.84	33.63	32.69	32.69	32.52	33.06	33.63	34.04	34.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.57	78.33	78.1	77.02	76.82	75.88	75.88	75.7	76.24	76.82	77.23	77.66	

Average = Sum(39)$_{1...12}$ /12= 77.02 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.06	1.06	1.05	1.04	1.04	1.02	1.02	1.02	1.03	1.04	1.04	1.05	

Average = Sum(40)$_{1...12}$ /12= 1.04 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.34 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.8 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.78	95.19	91.6	88.01	84.42	80.82	80.82	84.42	88.01	91.6	95.19	98.78	

Total = Sum(44)$_{1...12}$ = 1077.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.49	128.12	132.21	115.27	110.6	95.44	88.44	101.49	102.7	119.68	130.64	141.87	

Total = Sum(45)$_{1...12}$ = 1412.96 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.97	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.4	17.95	19.6	21.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	193.09	170.21	178.81	160.36	157.2	140.53	135.03	148.08	147.79	166.28	175.74	188.47	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	193.09	170.21	178.81	160.36	157.2	140.53	135.03	148.08	147.79	166.28	175.74	188.47

Output from water heater (annual)$_{1...12}$ | 1961.57 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.98	76.27	81.24	74.4	74.05	67.81	66.68	71.02	70.22	77.07	79.51	84.45	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.93	16.81	13.67	10.35	7.74	6.53	7.06	9.17	12.31	15.63	18.25	19.45	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	206.65	208.79	203.39	191.89	177.36	163.72	154.6	152.45	157.86	169.36	183.88	197.53	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	(71)

Water heating gains (Table 5)

(72)m=	115.57	113.5	109.19	103.33	99.53	94.18	89.63	95.46	97.53	103.59	110.43	113.51	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	402.26	400.22	387.37	366.69	345.75	325.54	312.4	318.2	328.82	349.7	373.68	391.61	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.6	x	10.63	x	0.63	x	0.7	=	14.95	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.63	x	0.7	=	28.57	(74)

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North	0.9x	0.77	x	4.6	x	34.53	x	0.63	x	0.7	=	48.54	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.63	x	0.7	=	77.97	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.63	x	0.7	=	105.04	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.63	x	0.7	=	112.44	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.63	x	0.7	=	104.98	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.63	x	0.7	=	83.29	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.63	x	0.7	=	58.36	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.63	x	0.7	=	34.01	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.63	x	0.7	=	18.44	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.63	x	0.7	=	12.46	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)

East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	64.65	125.79	208.65	311.49	391.22	405.4	383.89	322.86	244.58	149.37	80.41	53.33	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	466.91	526.01	596.02	678.17	736.96	730.94	696.29	641.07	573.4	499.07	454.09	444.94	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.83	0.64	0.48	0.53	0.81	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.91	20.05	20.3	20.62	20.87	20.98	21	20.99	20.92	20.59	20.2	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.03	20.04	20.04	20.05	20.05	20.06	20.06	20.07	20.06	20.05	20.05	20.04	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.78	0.56	0.38	0.43	0.73	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.58	18.78	19.14	19.61	19.93	20.05	20.06	20.06	20	19.58	19.01	18.56	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.11	19.29	19.6	20.02	20.3	20.42	20.44	20.43	20.36	19.99	19.48	19.09	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.11	19.29	19.6	20.02	20.3	20.42	20.44	20.43	20.36	19.99	19.48	19.09	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.8	0.59	0.42	0.47	0.76	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	464.82	521.32	582.09	627.33	586.55	430.33	289.66	302.76	435.61	476.39	449.91	443.38	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1163.65	1127.15	1023.51	856.26	660.99	441.57	291.04	305.43	477.62	720.98	956.34	1156.21	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	519.92	407.12	328.42	164.83	55.38	0	0	0	0	181.97	364.63	530.34	

Total per year (kWh/year) = $\text{Sum}(98)_{1...5,9...12}$ = | 2552.6 | (98)

Space heating requirement in kWh/m²/year | 34.45 | (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	519.92	407.12	328.42	164.83	55.38	0	0	0	0	181.97	364.63	530.34		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	556.07	435.42	351.25	176.28	59.23	0	0	0	0	194.62	389.98	567.21		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2730.06	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	193.09	170.21	178.81	160.36	157.2	140.53	135.03	148.08	147.79	166.28	175.74	188.47		
Efficiency of water heater													79.8	(216)
(217)m=	87.33	87.06	86.42	84.89	82.34	79.8	79.8	79.8	79.8	85.05	86.72	87.43		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	221.1	195.51	206.92	188.91	190.92	176.1	169.22	185.56	185.2	195.5	202.65	215.57		
Total = Sum(219a)$_{1...12}$ =													2333.16	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2730.06	
Water heating fuel used			2333.16	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			334.23	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	589.69	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	503.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1093.66	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	173.47	(268)
Total CO2, kg/year		sum of (265)…(271) =		1306.05	(272)

TER = 17.63 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-10-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	75.18	(1a) x	2.4	(2a) =	180.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.18	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	180.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 4			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Walls Type1	41.41	15.41	26	x	0.18	=	4.68			(29)
Walls Type2	4.86	2.1	2.76	x	0.18	=	0.5			(29)
Roof	75.18	0	75.18	x	0.11	=	8.27			(30)
Total area of elements, m²			121.45							(31)
Party wall			42	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	33.61	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		15.28	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	48.9	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.67	78.67	78.67	78.67	78.67	78.67	78.67	78.67	78.67	78.67	78.67	78.67	

Average = Sum(39)$_{1...12}$ /12= 78.67 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	

Average = Sum(40)$_{1...12}$ /12= 1.05 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.37 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.37 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	99.41	95.79	92.18	88.56	84.95	81.33	81.33	84.95	88.56	92.18	95.79	99.41	

Total = Sum(44)$_{1...12}$ = 1084.44 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.42	128.93	133.05	115.99	111.3	96.04	89	102.13	103.35	120.44	131.47	142.77	

Total = Sum(45)$_{1...12}$ = 1421.87 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.11	19.34	19.96	17.4	16.69	14.41	13.35	15.32	15.5	18.07	19.72	21.41	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.69	178.86	188.32	169.49	166.58	149.54	144.27	157.4	156.84	175.72	184.96	198.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.69	178.86	188.32	169.49	166.58	149.54	144.27	157.4	156.84	175.72	184.96	198.04

Output from water heater (annual)$_{1...12}$	2072.71	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.24	82.81	88.46	81.36	81.23	74.73	73.81	78.18	77.16	84.27	86.51	91.69	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.64	16.56	13.46	10.19	7.62	6.43	6.95	9.03	12.13	15.4	17.97	19.16	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	209.07	211.24	205.78	194.14	179.44	165.64	156.41	154.24	159.71	171.35	186.04	199.85	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	(71)

Water heating gains (Table 5)

(72)m=	125.32	123.23	118.9	113	109.18	103.79	99.21	105.08	107.16	113.26	120.15	123.24	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.51	409.51	396.61	375.81	354.72	334.33	321.05	326.83	337.47	358.48	382.64	400.72	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(76)
East	0.9x	1	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(76)

East	0.9x	1	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(76)
East	0.9x	1	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(76)
East	0.9x	1	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(76)
East	0.9x	1	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(76)
East	0.9x	1	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(76)
East	0.9x	1	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(76)
East	0.9x	1	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(76)
East	0.9x	1	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(76)
East	0.9x	1	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(76)
East	0.9x	1	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)

South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	159.95	271.13	366.39	444.56	488.08	479.88	464.62	433.09	393.73	298.53	191.37	137.01	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	571.46	680.64	763	820.36	842.8	814.22	785.67	759.92	731.2	657.01	574.01	537.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.78	0.6	0.44	0.47	0.7	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.05	20.24	20.48	20.73	20.9	20.98	21	21	20.96	20.73	20.33	20	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.87	0.72	0.52	0.34	0.38	0.62	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.79	19.07	19.41	19.74	19.96	20.03	20.04	20.04	20.02	19.75	19.19	18.72	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.3	19.54	19.84	20.14	20.34	20.41	20.43	20.42	20.39	20.14	19.65	19.23	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.3	19.54	19.84	20.14	20.34	20.41	20.43	20.42	20.39	20.14	19.65	19.23	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.94	0.87	0.74	0.55	0.38	0.41	0.65	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	565.63	663.99	720.52	717.04	624.81	448.25	299.89	314.97	474.04	587.84	560.92	533.62	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1179.65	1151.32	1049.07	883.95	679.4	457.24	300.91	316.57	495.02	750.66	987.13	1182.36	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	456.83	327.48	244.44	120.17	40.62	0	0	0	0	121.14	306.87	482.66	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = | 2100.22 | (98)

Space heating requirement in kWh/m²/year | 27.94 | (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.			
Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2100.22	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1653.92	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	551.31	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2072.71	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1632.26	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	544.09	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.82	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		48.65	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	48.65	(331)
Energy for lighting (calculated in Appendix L)		329.17	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4352.43	x	0.22	940.13	(363)

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less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1392.78	x	0.52		-722.85	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4295.42	x	0.22		927.81	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1374.54	x	0.52		-713.38	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	254.41	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	22.74	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	708.86	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					708.86	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	25.25	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	170.84	(379)
Total CO2, kg/year	sum of (376)…(382) =					904.94	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					12.04	(384)
EI rating (section 14)						89.91	(385)

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User Details:

Assessor Name: | **Stroma Number:**

Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-10-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	75.18	(1a) x	2.4	(2a) =	180.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.18	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	180.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 4			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Walls Type1	41.41	15.41	26	x	0.18	=	4.68			(29)
Walls Type2	4.86	2.1	2.76	x	0.18	=	0.5			(29)
Roof	75.18	0	75.18	x	0.13	=	9.77			(30)
Total area of elements, m²			121.45							(31)
Party wall			42	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.48 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.92 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 52.4 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	35.83	35.6	35.36	34.28	34.08	33.14	33.14	32.96	33.5	34.08	34.49	34.92	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.23	87.99	87.76	86.68	86.48	85.53	85.53	85.36	85.9	86.48	86.89	87.32	

Average = $Sum(39)_{1...12}$ /12= 86.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.17	1.17	1.17	1.15	1.15	1.14	1.14	1.14	1.14	1.15	1.16	1.16	

Average = $Sum(40)_{1...12}$ /12= 1.15 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.37 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.37 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	99.41	95.79	92.18	88.56	84.95	81.33	81.33	84.95	88.56	92.18	95.79	99.41	

Total = $Sum(44)_{1...12}$ = 1084.44 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.42	128.93	133.05	115.99	111.3	96.04	89	102.13	103.35	120.44	131.47	142.77	

Total = $Sum(45)_{1...12}$ = 1421.87 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.11	19.34	19.96	17.4	16.69	14.41	13.35	15.32	15.5	18.07	19.72	21.41	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	194.01	171.02	179.64	161.09	157.89	141.13	135.59	148.72	148.44	167.03	176.56	189.36	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	194.01	171.02	179.64	161.09	157.89	141.13	135.59	148.72	148.44	167.03	176.56	189.36	

Output from water heater (annual)$_{1...12}$ | 1970.49 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.29	76.54	81.51	74.64	74.28	68.01	66.87	71.23	70.44	77.32	79.79	84.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.73	16.63	13.53	10.24	7.65	6.46	6.98	9.08	12.18	15.47	18.05	19.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	209.07	211.24	205.78	194.14	179.44	165.64	156.41	154.24	159.71	171.35	186.04	199.85	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	(71)

Water heating gains (Table 5)

(72)m=	115.98	113.9	109.56	103.67	99.84	94.45	89.88	95.74	97.83	103.93	110.81	113.91	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	405.26	403.25	390.34	369.52	348.42	328.03	314.75	320.54	331.2	352.22	376.39	394.48	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.29	x	19.64	x	0.63	x	0.7	=	31.75	(76)
East	0.9x	1	x	5.29	x	38.42	x	0.63	x	0.7	=	62.11	(76)

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East	0.9x	1	x	5.29	x	63.27	x	0.63	x	0.7	=	102.29	(76)
East	0.9x	1	x	5.29	x	92.28	x	0.63	x	0.7	=	149.19	(76)
East	0.9x	1	x	5.29	x	113.09	x	0.63	x	0.7	=	182.84	(76)
East	0.9x	1	x	5.29	x	115.77	x	0.63	x	0.7	=	187.17	(76)
East	0.9x	1	x	5.29	x	110.22	x	0.63	x	0.7	=	178.19	(76)
East	0.9x	1	x	5.29	x	94.68	x	0.63	x	0.7	=	153.06	(76)
East	0.9x	1	x	5.29	x	73.59	x	0.63	x	0.7	=	118.97	(76)
East	0.9x	1	x	5.29	x	45.59	x	0.63	x	0.7	=	73.7	(76)
East	0.9x	1	x	5.29	x	24.49	x	0.63	x	0.7	=	39.59	(76)
East	0.9x	1	x	5.29	x	16.15	x	0.63	x	0.7	=	26.11	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.63	x	0.7	=	65.72	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.63	x	0.7	=	107.64	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.63	x	0.7	=	137.12	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.63	x	0.7	=	154.97	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.63	x	0.7	=	161.49	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.63	x	0.7	=	155.41	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.63	x	0.7	=	151.85	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.63	x	0.7	=	147.46	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.63	x	0.7	=	143.23	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.63	x	0.7	=	116.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)

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South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.63	x	0.7	=	77.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.63	x	0.7	=	56.79	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	176.35	298.92	403.95	490.12	538.11	529.07	512.25	477.48	434.08	329.12	210.99	151.05	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	581.61	702.17	794.29	859.64	886.53	857.1	826.99	798.02	765.28	681.34	587.37	545.53	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.79	0.61	0.45	0.49	0.71	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.89	20.1	20.37	20.66	20.87	20.97	21	20.99	20.94	20.66	20.22	19.85	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.94	19.94	19.95	19.96	19.96	19.97	19.97	19.97	19.97	19.96	19.96	19.95	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.88	0.73	0.53	0.35	0.38	0.63	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.48	18.78	19.17	19.58	19.84	19.95	19.97	19.97	19.92	19.6	18.97	18.43	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.04	19.31	19.65	20.01	20.25	20.36	20.38	20.38	20.33	20.02	19.47	19	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.04	19.31	19.65	20.01	20.25	20.36	20.38	20.38	20.33	20.02	19.47	19	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.88	0.75	0.56	0.39	0.42	0.66	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	575.55	684.9	750.86	754.25	665.44	479.64	321.56	337.07	505.4	612.52	574.06	541.23	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1300.62	1267.93	1153.93	963.33	739.71	492.76	323.25	339.63	535.27	814.98	1074.48	1292.04	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	539.46	391.79	299.88	150.53	55.26	0	0	0	0	150.63	360.3	558.61	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 2506.46 (98)

Space heating requirement in kWh/m²/year 33.34 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	539.46	391.79	299.88	150.53	55.26	0	0	0	0	150.63	360.3	558.61		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	576.96	419.03	320.73	161	59.1	0	0	0	0	161.1	385.34	597.44		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2680.7	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	194.01	171.02	179.64	161.09	157.89	141.13	135.59	148.72	148.44	167.03	176.56	189.36		
Efficiency of water heater													79.8	(216)
(217)m=	87.4	86.96	86.17	84.63	82.32	79.8	79.8	79.8	79.8	84.54	86.68	87.53		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	221.98	196.67	208.47	190.33	191.8	176.86	169.91	186.37	186.01	197.58	203.7	216.34		
Total = Sum(219a)$_{1...12}$ =													2346.02	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2680.7	
Water heating fuel used			2346.02	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			330.71	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	579.03	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	506.74	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1085.77	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	171.64	(268)
Total CO2, kg/year		sum of (265)…(271) =		1296.33	(272)

TER = 17.24 (273)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b2-10-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	66.83	(1a) x	2.4	(2a) =	160.39	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	66.83	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	160.39	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			6.9	x1/[1/(1.2)+ 0.04]		=	7.9			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	37.48	14.26	23.22	x	0.18	=	4.18			(29)
Walls Type2	25.22	2.1	23.12	x	0.18	=	4.16			(29)
Roof	66.83	0	66.83	x	0.11	=	7.35			(30)
Total area of elements, m²			129.53							(31)
Party wall			19.67	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.54 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 13.8 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 48.34 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26.46	26.46	26.46	26.46	26.46	26.46	26.46	26.46	26.46	26.46	26.46	26.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	74.81	74.81	74.81	74.81	74.81	74.81	74.81	74.81	74.81	74.81	74.81	74.81	

Average = Sum(39)$_{1…12}$ /12= 74.81 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12

Average = Sum(40)$_{1…12}$ /12= 1.12 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.17 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 85.66 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	94.23	90.8	87.37	83.95	80.52	77.09	77.09	80.52	83.95	87.37	90.8	94.23

Total = Sum(44)$_{1…12}$ = 1027.93 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	139.74	122.21	126.11	109.95	105.5	91.04	84.36	96.8	97.96	114.16	124.62	135.33

Total = Sum(45)$_{1…12}$ = 1347.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.96	18.33	18.92	16.49	15.82	13.66	12.65	14.52	14.69	17.12	18.69	20.3	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	195.01	172.14	181.39	163.44	160.78	144.53	139.64	152.08	151.45	169.44	178.11	190.6	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	195.01	172.14	181.39	163.44	160.78	144.53	139.64	152.08	151.45	169.44	178.11	190.6	

Output from water heater (annual)$_{1...12}$ | 1998.62 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.68	80.58	86.15	79.35	79.3	73.06	72.27	76.41	75.37	82.18	84.23	89.22	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	16.92	15.03	12.22	9.25	6.92	5.84	6.31	8.2	11.01	13.98	16.31	17.39	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	189.79	191.76	186.79	176.23	162.89	150.36	141.98	140.01	144.98	155.54	168.88	181.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	(71)

Water heating gains (Table 5)

(72)m=	121.89	119.91	115.8	110.21	106.59	101.48	97.14	102.7	104.68	110.46	116.99	119.92	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	384.1	382.2	370.32	351.2	331.9	313.18	300.93	306.42	316.16	335.48	357.68	374.22	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	6.9	x	46.75	x	0.5	x	0.8	=	89.42	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)

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South	0.9x	0.77	x	6.9	x	76.57	x	0.5	x	0.8	=	146.45	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	6.9	x	97.53	x	0.5	x	0.8	=	186.55	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	6.9	x	110.23	x	0.5	x	0.8	=	210.84	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	6.9	x	114.87	x	0.5	x	0.8	=	219.71	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	6.9	x	110.55	x	0.5	x	0.8	=	211.44	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	6.9	x	108.01	x	0.5	x	0.8	=	206.59	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	6.9	x	104.89	x	0.5	x	0.8	=	200.63	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	6.9	x	101.89	x	0.5	x	0.8	=	194.87	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	6.9	x	82.59	x	0.5	x	0.8	=	157.96	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	6.9	x	55.42	x	0.5	x	0.8	=	106	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	6.9	x	40.4	x	0.5	x	0.8	=	77.27	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)

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West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	150.23	254.02	341.85	412.85	451.8	443.64	429.77	401.6	366.66	279.28	179.62	128.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	534.33	636.22	712.17	764.05	783.7	756.82	730.7	708.02	682.82	614.75	537.3	502.99	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.78	0.61	0.45	0.48	0.7	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.98	20.18	20.43	20.69	20.88	20.97	21	20.99	20.95	20.7	20.28	19.93	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.87	0.73	0.52	0.35	0.38	0.62	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.65	18.93	19.29	19.64	19.88	19.97	19.98	19.98	19.95	19.66	19.08	18.57	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.18	19.43	19.75	20.06	20.28	20.37	20.39	20.39	20.35	20.08	19.56	19.12	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.18	19.43	19.75	20.06	20.28	20.37	20.39	20.39	20.35	20.08	19.56	19.12	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.87	0.74	0.56	0.39	0.42	0.65	0.89	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	527.86	618.72	669.86	666.12	582.94	421.03	282.06	296.22	444.1	547.36	523.37	498.35	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1113.49	1087.21	990.87	835.06	641.97	431.76	283.4	298.27	467.44	708.86	931.89	1115.92	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	435.71	314.82	238.83	121.64	43.92	0	0	0	0	120.15	294.13	459.47	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 2028.68 | (98)

Space heating requirement in kWh/m²/year | 30.36 | (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2028.68	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1597.59	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	532.53	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1998.62	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1573.91	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	524.64	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	42.29	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		43.24	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	43.24	(331)
Energy for lighting (calculated in Appendix L)		298.81	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit				32	(361)
Heat efficiency of CHP unit				38	(362)
		Energy kWh/year	**Emission factor kg CO2/kWh**	**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4204.17	x 0.22	908.1	(363)

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less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1345.34	x	0.52		-698.23	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4141.88	x	0.22		894.65	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1325.4	x	0.52		-687.88	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	245.54	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	21.95	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	684.12	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					684.12	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	22.44	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	155.08	(379)
Total CO2, kg/year	sum of (376)…(382) =					861.64	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					12.89	(384)
EI rating (section 14)						89.68	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-10-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	66.83	(1a)	x	2.4	(2a)	=	160.39	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	66.83	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		160.39	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.37	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.32	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			6.9	x1/[1/(1.4)+ 0.04]		=	9.15			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Walls Type1	37.48	14.26	23.22	x	0.18	=	4.18			(29)
Walls Type2	25.22	2.1	23.12	x	0.18	=	4.16			(29)
Roof	66.83	0	66.83	x	0.13	=	8.69			(30)
Total area of elements, m²			129.53							(31)
Party wall			19.67	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.03 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.23 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 52.27 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	30.83	30.66	30.49	29.71	29.57	28.89	28.89	28.76	29.15	29.57	29.86	30.17	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	83.1	82.93	82.76	81.98	81.83	81.15	81.15	81.03	81.42	81.83	82.13	82.44	

Average = Sum(39)$_{1...12}$ /12= 81.98 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.24	1.24	1.24	1.23	1.22	1.21	1.21	1.21	1.22	1.22	1.23	1.23

Average = Sum(40)$_{1...12}$ /12= 1.23 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.17 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 85.66 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	94.23	90.8	87.37	83.95	80.52	77.09	77.09	80.52	83.95	87.37	90.8	94.23

Total = Sum(44)$_{1...12}$ = 1027.93 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	139.74	122.21	126.11	109.95	105.5	91.04	84.36	96.8	97.96	114.16	124.62	135.33

Total = Sum(45)$_{1...12}$ = 1347.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.96	18.33	18.92	16.49	15.82	13.66	12.65	14.52	14.69	17.12	18.69	20.3	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	186.33	164.3	172.71	155.04	152.09	136.13	130.95	143.4	143.05	160.76	169.71	181.92	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	186.33	164.3	172.71	155.04	152.09	136.13	130.95	143.4	143.05	160.76	169.71	181.92

Output from water heater (annual)$_{1...12}$	1896.4	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	83.74	74.3	79.21	72.63	72.35	66.34	65.33	69.46	68.65	75.24	77.51	82.27	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	16.95	15.05	12.24	9.27	6.93	5.85	6.32	8.22	11.03	14	16.34	17.42	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	189.79	191.76	186.79	176.23	162.89	150.36	141.98	140.01	144.98	155.54	168.88	181.41	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	(71)
Water heating gains (Table 5)													
(72)m=	112.55	110.57	106.46	100.88	97.25	92.14	87.8	93.36	95.34	101.12	107.65	110.58	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	377.79	375.89	364	344.88	325.57	306.85	294.61	300.1	309.85	329.17	351.37	367.92	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	6.9	x	46.75	x	0.63	x	0.7	=	98.59	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)

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South	0.9x	0.77	x	6.9	x	76.57	x	0.63	x	0.7	=	161.46	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	6.9	x	97.53	x	0.63	x	0.7	=	205.67	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	6.9	x	110.23	x	0.63	x	0.7	=	232.45	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	6.9	x	114.87	x	0.63	x	0.7	=	242.23	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	6.9	x	110.55	x	0.63	x	0.7	=	233.12	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	6.9	x	108.01	x	0.63	x	0.7	=	227.77	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	6.9	x	104.89	x	0.63	x	0.7	=	221.19	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	6.9	x	101.89	x	0.63	x	0.7	=	214.85	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	6.9	x	82.59	x	0.63	x	0.7	=	174.15	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	6.9	x	55.42	x	0.63	x	0.7	=	116.86	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	6.9	x	40.4	x	0.63	x	0.7	=	85.19	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.63	x	0.7	=	11.04	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.63	x	0.7	=	21.6	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.63	x	0.7	=	35.58	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.63	x	0.7	=	51.89	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.63	x	0.7	=	63.6	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.63	x	0.7	=	65.1	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.63	x	0.7	=	61.98	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.63	x	0.7	=	53.24	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)

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West	0.9x	0.77	x	1.84	x	45.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.63	x	0.7	=	13.77	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.63	x	0.7	=	9.08	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	165.63	280.06	376.89	455.17	498.11	489.11	473.82	442.77	404.24	307.9	198.03	141.97	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	543.42	655.94	740.89	800.04	823.69	795.97	768.43	742.87	714.09	637.07	549.4	509.89	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.79	0.62	0.46	0.49	0.72	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.83	20.04	20.32	20.63	20.85	20.96	20.99	20.99	20.93	20.63	20.17	19.78	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.89	19.89	19.89	19.9	19.9	19.91	19.91	19.91	19.91	19.9	19.9	19.89	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.87	0.73	0.53	0.35	0.38	0.63	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.35	18.67	19.06	19.49	19.76	19.89	19.91	19.91	19.86	19.51	18.85	18.3	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.94	19.22	19.57	19.94	20.2	20.32	20.34	20.34	20.29	19.96	19.38	18.89	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.94	19.22	19.57	19.94	20.2	20.32	20.34	20.34	20.29	19.96	19.38	18.89	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.87	0.75	0.56	0.39	0.43	0.66	0.89	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	536.68	637.61	697.01	698.94	618.2	448.98	301.49	316.13	471.62	569.25	535.15	505.02	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1216.79	1187.38	1081.43	905.17	695.45	464.05	303.6	319.26	503.61	765.88	1008.51	1211.16	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	506	369.45	286.01	148.49	57.48	0	0	0	0	146.29	340.82	525.37	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2379.9 (98)

Space heating requirement in kWh/m²/year 35.61 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	506	369.45	286.01	148.49	57.48	0	0	0	0	146.29	340.82	525.37		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	541.18	395.13	305.89	158.81	61.48	0	0	0	0	156.46	364.51	561.89		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													2545.35	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	186.33	164.3	172.71	155.04	152.09	136.13	130.95	143.4	143.05	160.76	169.71	181.92		
Efficiency of water heater													79.8	(216)
(217)m=	87.35	86.91	86.15	84.7	82.47	79.8	79.8	79.8	79.8	84.56	86.64	87.48		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	213.32	189.04	200.47	183.05	184.41	170.59	164.1	179.7	179.26	190.1	195.88	207.95		
Total = Sum(219a)$_{1...12}$ =													2257.88	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2545.35	
Water heating fuel used			2257.88	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			299.32	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	549.8	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	487.7	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1037.5	(265)

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Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	155.35	(268)
Total CO2, kg/year			sum of (265)…(271) =		1231.77	(272)

TER = 18.43 (273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-10-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	49.58	(1a) x	2.4	(2a) =	118.99	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		118.99	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			6.8	x1/[1/(1.2)+ 0.04]		=	7.79			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	29.01	13.24	15.77	x	0.18	=	2.84			(29)
Walls Type2	27.91	2.1	25.81	x	0.18	=	4.65			(29)
Total area of elements, m²			56.92							(31)
Party wall			15.1	x	0	=	0			(32)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.16 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.35 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 34.51 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	54.15	54.15	54.15	54.15	54.15	54.15	54.15	54.15	54.15	54.15	54.15	54.15	

Average = Sum(39)$_{1…12}$ /12= 54.15 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09

Average = Sum(40)$_{1...12}$ /12= 1.09 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.68 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	81.45	78.49	75.53	72.57	69.6	66.64	66.64	69.6	72.57	75.53	78.49	81.45	
										Total = Sum(44)$_{1...12}$ =		888.56	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	120.79	105.64	109.01	95.04	91.19	78.69	72.92	83.68	84.68	98.68	107.72	116.98	
										Total = Sum(45)$_{1...12}$ =		1165.04	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.12	15.85	16.35	14.26	13.68	11.8	10.94	12.55	12.7	14.8	16.16	17.55	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	176.07	155.57	164.29	148.54	146.47	132.19	128.2	138.96	138.17	153.96	161.21	172.25	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	176.07	155.57	164.29	148.54	146.47	132.19	128.2	138.96	138.17	153.96	161.21	172.25	

Output from water heater (annual)$_{1...12}$ 1815.88 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.38	75.07	80.47	74.4	74.54	68.96	68.47	72.04	70.95	77.03	78.61	83.12	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.03	11.57	9.41	7.12	5.33	4.5	4.86	6.32	8.48	10.76	12.56	13.39	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	146.14	147.66	143.84	135.7	125.43	115.78	109.33	107.82	111.64	119.77	130.04	139.69	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	(71)

Water heating gains (Table 5)

(72)m=	113.42	111.71	108.16	103.33	100.19	95.78	92.03	96.83	98.54	103.54	109.18	111.72	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	320.76	319.11	309.57	294.32	279.12	264.22	254.38	259.13	266.82	282.24	299.95	312.97	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)

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South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
West	0.9x	0.77	x	6.8	x	19.64	x	0.5	x	0.8	=	37.02	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	6.8	x	38.42	x	0.5	x	0.8	=	72.42	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	6.8	x	63.27	x	0.5	x	0.8	=	119.27	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	6.8	x	92.28	x	0.5	x	0.8	=	173.94	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	6.8	x	113.09	x	0.5	x	0.8	=	213.18	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	6.8	x	115.77	x	0.5	x	0.8	=	218.22	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	6.8	x	110.22	x	0.5	x	0.8	=	207.76	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	6.8	x	94.68	x	0.5	x	0.8	=	178.46	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	6.8	x	73.59	x	0.5	x	0.8	=	138.71	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	6.8	x	45.59	x	0.5	x	0.8	=	85.93	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	6.8	x	24.49	x	0.5	x	0.8	=	46.16	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	6.8	x	16.15	x	0.5	x	0.8	=	30.44	(80)

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West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	85.91	160.47	249.7	347.84	415.97	422.23	403.39	352.68	284.51	186.19	105.65	71.64	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	406.67	479.57	559.27	642.16	695.09	686.45	657.77	611.82	551.34	468.43	405.61	384.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.85	0.68	0.5	0.36	0.4	0.65	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.23	20.51	20.79	20.94	20.99	21	21	20.97	20.73	20.32	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.81	0.62	0.42	0.28	0.32	0.57	0.87	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.75	19.02	19.41	19.78	19.96	20	20.01	20.01	19.98	19.73	19.16	18.68	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.63	19.96	20.28	20.45	20.5	20.5	20.5	20.48	20.23	19.74	19.33	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.63	19.96	20.28	20.45	20.5	20.5	20.5	20.48	20.23	19.74	19.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.93	0.82	0.65	0.46	0.32	0.36	0.6	0.88	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	401.33	465.67	519.08	527.91	451.54	316.15	210.95	221.41	333.5	412.75	394.52	380.7	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	817.39	797.43	728.88	616.46	473.84	319.27	211.32	222.11	345.24	521.44	684.36	819.44	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	309.55	222.94	156.09	63.75	16.59	0	0	0	0	80.87	208.69	326.43	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1384.9 (98)

Space heating requirement in kWh/m^2/year 27.93 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1384.9	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1090.61	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	363.54	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		1815.88	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1430	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	476.67	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	33.61	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		32.08	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	32.08	(331)
Energy for lighting (calculated in Appendix L)		230.09	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		**Emission factor kg CO2/kWh**	**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	2870.03	x	0.22	619.93	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	918.41	x	0.52	-476.65	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	3763.17	x	0.22	812.84	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1204.21	x	0.52	-624.99	(366)

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Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	195.14	(368)
Electrical energy for heat distribution	[(313) x	0.52	=	17.44	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	543.72	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			543.72	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	16.65	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	119.42	(379)
Total CO2, kg/year	sum of (376)…(382) =			679.78	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			13.71	(384)
EI rating (section 14)				90.37	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-10-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	49.58	(1a) x	2.4	(2a) =	118.99	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.58	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	118.99	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 2			1.43	x1/[1/(1.4)+ 0.04]		=	1.9			(27)
Windows Type 3			2.15	x1/[1/(1.4)+ 0.04]		=	2.85			(27)
Windows Type 4			1.43	x1/[1/(1.4)+ 0.04]		=	1.9			(27)
Walls Type1	29.01	10.3	18.71	x	0.18	=	3.37			(29)
Walls Type2	27.91	2.1	25.81	x	0.18	=	4.65			(29)
Total area of elements, m²			56.92							(31)
Party wall			15.1	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 23.77 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.15 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 30.92 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	23.66	23.51	23.35	22.63	22.5	21.87	21.87	21.76	22.11	22.5	22.77	23.06	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	54.58	54.43	54.27	53.55	53.42	52.79	52.79	52.68	53.03	53.42	53.69	53.98	

Average = Sum(39)$_{1…12}$ /12= 53.55 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.1	1.1	1.09	1.08	1.08	1.06	1.06	1.06	1.07	1.08	1.08	1.09

Average = Sum(40)$_{1\ldots12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.68 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	81.45	78.49	75.53	72.57	69.6	66.64	66.64	69.6	72.57	75.53	78.49	81.45	
										Total = Sum(44)$_{1\ldots12}$ =		888.56	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	120.79	105.64	109.01	95.04	91.19	78.69	72.92	83.68	84.68	98.68	107.72	116.98	
										Total = Sum(45)$_{1\ldots12}$ =		1165.04	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.12	15.85	16.35	14.26	13.68	11.8	10.94	12.55	12.7	14.8	16.16	17.55	(46)

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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	167.38	147.73	155.61	140.13	137.79	123.79	119.52	130.27	129.77	145.28	152.81	163.57	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	167.38	147.73	155.61	140.13	137.79	123.79	119.52	130.27	129.77	145.28	152.81	163.57	

Output from water heater (annual)$_{1...12}$ 1713.66 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.44	68.79	73.52	67.67	67.6	62.24	61.52	65.1	64.23	70.09	71.89	76.17	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.07	11.61	9.44	7.15	5.34	4.51	4.88	6.34	8.51	10.8	12.61	13.44	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	146.14	147.66	143.84	135.7	125.43	115.78	109.33	107.82	111.64	119.77	130.04	139.69	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	(71)

Water heating gains (Table 5)

(72)m=	104.08	102.37	98.82	93.99	90.86	86.44	82.69	87.5	89.21	94.2	99.85	102.38	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	314.47	312.81	303.27	288.01	272.8	257.9	248.07	252.82	260.52	275.94	293.66	306.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	1.43	x	46.75	x	0.63	x	0.7	=	20.43	(78)
South	0.9x	0.77	x	1.43	x	76.57	x	0.63	x	0.7	=	33.46	(78)
South	0.9x	0.77	x	1.43	x	97.53	x	0.63	x	0.7	=	42.62	(78)
South	0.9x	0.77	x	1.43	x	110.23	x	0.63	x	0.7	=	48.18	(78)
South	0.9x	0.77	x	1.43	x	114.87	x	0.63	x	0.7	=	50.2	(78)

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South	0.9x	0.77	x	1.43	x	110.55	x	0.63	x	0.7	=	48.31	(78)
South	0.9x	0.77	x	1.43	x	108.01	x	0.63	x	0.7	=	47.2	(78)
South	0.9x	0.77	x	1.43	x	104.89	x	0.63	x	0.7	=	45.84	(78)
South	0.9x	0.77	x	1.43	x	101.89	x	0.63	x	0.7	=	44.53	(78)
South	0.9x	0.77	x	1.43	x	82.59	x	0.63	x	0.7	=	36.09	(78)
South	0.9x	0.77	x	1.43	x	55.42	x	0.63	x	0.7	=	24.22	(78)
South	0.9x	0.77	x	1.43	x	40.4	x	0.63	x	0.7	=	17.66	(78)
West	0.9x	0.77	x	5.29	x	19.64	x	0.63	x	0.7	=	31.75	(80)
West	0.9x	0.77	x	1.43	x	19.64	x	0.63	x	0.7	=	8.58	(80)
West	0.9x	0.77	x	2.15	x	19.64	x	0.63	x	0.7	=	12.9	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.63	x	0.7	=	62.11	(80)
West	0.9x	0.77	x	1.43	x	38.42	x	0.63	x	0.7	=	16.79	(80)
West	0.9x	0.77	x	2.15	x	38.42	x	0.63	x	0.7	=	25.24	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.63	x	0.7	=	102.29	(80)
West	0.9x	0.77	x	1.43	x	63.27	x	0.63	x	0.7	=	27.65	(80)
West	0.9x	0.77	x	2.15	x	63.27	x	0.63	x	0.7	=	41.57	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.63	x	0.7	=	149.19	(80)
West	0.9x	0.77	x	1.43	x	92.28	x	0.63	x	0.7	=	40.33	(80)
West	0.9x	0.77	x	2.15	x	92.28	x	0.63	x	0.7	=	60.63	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.63	x	0.7	=	182.84	(80)
West	0.9x	0.77	x	1.43	x	113.09	x	0.63	x	0.7	=	49.42	(80)
West	0.9x	0.77	x	2.15	x	113.09	x	0.63	x	0.7	=	74.31	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.63	x	0.7	=	187.17	(80)
West	0.9x	0.77	x	1.43	x	115.77	x	0.63	x	0.7	=	50.59	(80)
West	0.9x	0.77	x	2.15	x	115.77	x	0.63	x	0.7	=	76.07	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.63	x	0.7	=	178.19	(80)
West	0.9x	0.77	x	1.43	x	110.22	x	0.63	x	0.7	=	48.17	(80)
West	0.9x	0.77	x	2.15	x	110.22	x	0.63	x	0.7	=	72.42	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.63	x	0.7	=	153.06	(80)
West	0.9x	0.77	x	1.43	x	94.68	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	2.15	x	94.68	x	0.63	x	0.7	=	62.21	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.63	x	0.7	=	118.97	(80)
West	0.9x	0.77	x	1.43	x	73.59	x	0.63	x	0.7	=	32.16	(80)
West	0.9x	0.77	x	2.15	x	73.59	x	0.63	x	0.7	=	48.35	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.63	x	0.7	=	73.7	(80)
West	0.9x	0.77	x	1.43	x	45.59	x	0.63	x	0.7	=	19.92	(80)
West	0.9x	0.77	x	2.15	x	45.59	x	0.63	x	0.7	=	29.96	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.63	x	0.7	=	39.59	(80)
West	0.9x	0.77	x	1.43	x	24.49	x	0.63	x	0.7	=	10.7	(80)
West	0.9x	0.77	x	2.15	x	24.49	x	0.63	x	0.7	=	16.09	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.63	x	0.7	=	26.11	(80)

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West	0.9x	0.77	x	1.43	x	16.15	x	0.63	x	0.7	=	7.06	(80)
West	0.9x	0.77	x	2.15	x	16.15	x	0.63	x	0.7	=	10.61	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	73.67	137.61	214.14	298.33	356.77	362.14	345.98	302.49	244.01	159.67	90.6	61.44	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	388.14	450.42	517.42	586.34	629.57	620.04	594.05	555.31	504.53	435.62	384.27	368.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.88	0.73	0.54	0.39	0.43	0.68	0.92	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.17	20.44	20.75	20.93	20.99	21	21	20.96	20.71	20.29	19.96	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20	20.01	20.02	20.02	20.03	20.03	20.03	20.03	20.02	20.01	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.85	0.67	0.46	0.3	0.34	0.6	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.68	18.94	19.32	19.74	19.95	20.02	20.03	20.03	20	19.7	19.12	18.64	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.34	19.55	19.88	20.24	20.44	20.51	20.51	20.51	20.48	20.2	19.71	19.3	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.34	19.55	19.88	20.24	20.44	20.51	20.51	20.51	20.48	20.2	19.71	19.3	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.94	0.86	0.7	0.5	0.35	0.39	0.64	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	383.95	440.19	488.69	501.57	437.68	307.79	206.13	215.83	323.89	392.63	375.64	364.99	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	820.75	797.61	726.37	607.48	466.88	311.76	206.61	216.69	338.28	513.02	677.04	815.21	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	324.98	240.19	176.84	76.26	21.73	0	0	0	0	89.57	217	334.96	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1481.53 (98)

Space heating requirement in kWh/m²/year 29.88 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	324.98	240.19	176.84	76.26	21.73	0	0	0	0	89.57	217	334.96		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	347.57	256.89	189.13	81.56	23.24	0	0	0	0	95.79	232.09	358.25		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													1584.52	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	167.38	147.73	155.61	140.13	137.79	123.79	119.52	130.27	129.77	145.28	152.81	163.57		
Efficiency of water heater													79.8	(216)
(217)m=	86.55	86.1	85.16	83.27	81.11	79.8	79.8	79.8	79.8	83.57	85.75	86.69		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	193.39	171.57	182.74	168.29	169.89	155.12	149.77	163.25	162.62	173.84	178.21	188.7		
Total = Sum(219a)$_{1...12}$ =													2057.38	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1584.52	
Water heating fuel used			2057.38	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			230.91	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	342.26	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	444.39	(264)
Space and water heating	(261) + (262) + (263) + (264) =				786.65	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	119.84	(268)

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Total CO2, kg/year	sum of (265)…(271) =	945.42	(272)
TER =		19.07	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-11-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	58.5	(1a) x	2.4	(2a) =	140.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	58.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	140.4	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	40.78	12.88	27.9	x	0.18	=	5.02			(29)
Walls Type2	29.77	2.1	27.67	x	0.18	=	4.98			(29)
Total area of elements, m²			70.55							(31)
Party wall			11.01	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	27.27	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		11.36	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	38.63	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	23.17	23.17	23.17	23.17	23.17	23.17	23.17	23.17	23.17	23.17	23.17	23.17	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	61.8	61.8	61.8	61.8	61.8	61.8	61.8	61.8	61.8	61.8	61.8	61.8

Average = Sum(39)$_{1...12}$ /12= 61.8 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06

Average = Sum(40)1…12 /12= 1.06 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.94 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 80.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	88.27	85.06	81.85	78.64	75.43	72.22	72.22	75.43	78.64	81.85	85.06	88.27	
										Total = Sum(44)1…12 =		962.99	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	130.91	114.49	118.15	103	98.83	85.29	79.03	90.69	91.77	106.95	116.75	126.78	
										Total = Sum(45)1…12 =		1262.64	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	19.64	17.17	17.72	15.45	14.83	12.79	11.85	13.6	13.77	16.04	17.51	19.02	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	186.19	164.42	173.42	156.5	154.11	138.78	134.31	145.97	145.27	162.23	170.24	182.05	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	186.19	164.42	173.42	156.5	154.11	138.78	134.31	145.97	145.27	162.23	170.24	182.05	

Output from water heater (annual)$_{1...12}$ 1913.47 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	87.75	78.01	83.51	77.04	77.08	71.15	70.5	74.38	73.31	79.78	81.61	86.38	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	15.08	13.39	10.89	8.25	6.16	5.2	5.62	7.31	9.81	12.46	14.54	15.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	169.15	170.9	166.48	157.06	145.18	134.01	126.54	124.79	129.21	138.63	150.51	161.69	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	(71)

Water heating gains (Table 5)

(72)m=	117.94	116.09	112.24	107	103.61	98.82	94.76	99.97	101.82	107.23	113.35	116.1	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	354.25	352.47	341.7	324.4	307.03	290.12	279.01	284.15	292.92	310.4	330.49	345.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)

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East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)

South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	104.69	185.82	269.59	352.36	406.05	406.68	390.7	351.05	298.82	209.94	126.87	88.58	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	458.95	538.29	611.29	676.76	713.08	696.8	669.71	635.2	591.74	520.35	457.36	433.95	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.88	0.74	0.56	0.4	0.44	0.68	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.24	20.49	20.75	20.92	20.99	21	21	20.96	20.73	20.33	20.01	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.85	0.68	0.48	0.32	0.35	0.6	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.8	19.06	19.41	19.77	19.97	20.03	20.04	20.04	20.01	19.75	19.19	18.73	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.43	19.65	19.95	20.26	20.45	20.51	20.52	20.52	20.49	20.24	19.76	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.43	19.65	19.95	20.26	20.45	20.51	20.52	20.52	20.49	20.24	19.76	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.94	0.86	0.71	0.52	0.36	0.4	0.64	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	453.82	524.88	575.31	580.92	505.01	359.63	241.42	253.26	378.58	465.35	446.45	430.23	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	934.92	911.45	831.33	702.07	540.51	365.07	242.06	254.36	394.65	595.62	782.58	937.36	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	357.94	259.78	190.48	87.23	26.41	0	0	0	0	96.92	242.01	377.31	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1638.09 (98)

Space heating requirement in kWh/m²/year 28 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1638.09	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1289.99	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	430	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1913.47	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1506.86	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	502.29	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	37.29	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		37.85	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	37.85	(331)
Energy for lighting (calculated in Appendix L)		266.31	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	3394.72	x	0.22	733.26	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1086.31	x	0.52	-563.79	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	3965.42	x	0.22	856.53	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1268.94	x	0.52	-658.58	(366)

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Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	216.53	(368)
Electrical energy for heat distribution	[(313) x	0.52	=	19.35	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	603.3	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			603.3	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	19.65	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	138.22	(379)
Total CO2, kg/year	sum of (376)…(382) =			761.17	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			13.01	(384)
EI rating (section 14)				90.15	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-11-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	58.5	(1a) x	2.4	(2a) =	140.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	58.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	140.4	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.39	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.68	x1/[1/(1.4)+ 0.04]		=	3.55			(27)
Windows Type 2			2.68	x1/[1/(1.4)+ 0.04]		=	3.55			(27)
Windows Type 3			4.47	x1/[1/(1.4)+ 0.04]		=	5.93			(27)
Windows Type 4			2.68	x1/[1/(1.4)+ 0.04]		=	3.55			(27)
Walls Type1	40.78	12.51	28.27	x	0.18	=	5.09			(29)
Walls Type2	29.77	2.1	27.67	x	0.18	=	4.98			(29)
Total area of elements, m²			70.55							(31)
Party wall			11.01	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	28.75	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		8.41	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	37.16	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	27.36	27.19	27.03	26.29	26.15	25.49	25.49	25.37	25.74	26.15	26.43	26.73	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.52	64.36	64.2	63.45	63.31	62.66	62.66	62.54	62.91	63.31	63.59	63.89	

Average = $Sum(39)_{1…12}$ /12= 63.45 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.1	1.1	1.1	1.08	1.08	1.07	1.07	1.07	1.08	1.08	1.09	1.09	

Average = Sum(40)$_{1…12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.94 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 80.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	88.27	85.06	81.85	78.64	75.43	72.22	72.22	75.43	78.64	81.85	85.06	88.27	

Total = Sum(44)$_{1…12}$ = 962.99 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	130.91	114.49	118.15	103	98.83	85.29	79.03	90.69	91.77	106.95	116.75	126.78	

Total = Sum(45)$_{1…12}$ = 1262.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	19.64	17.17	17.72	15.45	14.83	12.79	11.85	13.6	13.77	16.04	17.51	19.02	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	177.5	156.58	164.74	148.1	145.43	130.38	125.63	137.28	136.86	153.55	161.84	173.37	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	177.5	156.58	164.74	148.1	145.43	130.38	125.63	137.28	136.86	153.55	161.84	173.37	

Output from water heater (annual)$_{1...12}$ 1811.25 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	80.8	71.74	76.56	70.32	70.14	64.43	63.55	67.43	66.59	72.84	74.89	79.43	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	15.1	13.42	10.91	8.26	6.17	5.21	5.63	7.32	9.83	12.48	14.56	15.52	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	169.15	170.9	166.48	157.06	145.18	134.01	126.54	124.79	129.21	138.63	150.51	161.69	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	(71)
Water heating gains (Table 5)													
(72)m=	108.61	106.75	102.9	97.67	94.27	89.49	85.42	90.63	92.48	97.9	104.02	106.76	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	347.94	346.16	335.38	318.08	300.71	283.79	272.68	277.82	286.6	304.09	324.18	339.05	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	2.68	x	19.64	x	0.63	x	0.7	=	16.09	(76)
East	0.9x	1	x	2.68	x	19.64	x	0.63	x	0.7	=	16.09	(76)
East	0.9x	1	x	2.68	x	19.64	x	0.63	x	0.7	=	16.09	(76)
East	0.9x	1	x	2.68	x	38.42	x	0.63	x	0.7	=	31.47	(76)
East	0.9x	1	x	2.68	x	38.42	x	0.63	x	0.7	=	31.47	(76)

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East	0.9x	1	x	2.68	x	38.42	x	0.63	x	0.7	=	31.47	(76)
East	0.9x	1	x	2.68	x	63.27	x	0.63	x	0.7	=	51.82	(76)
East	0.9x	1	x	2.68	x	63.27	x	0.63	x	0.7	=	51.82	(76)
East	0.9x	1	x	2.68	x	63.27	x	0.63	x	0.7	=	51.82	(76)
East	0.9x	1	x	2.68	x	92.28	x	0.63	x	0.7	=	75.58	(76)
East	0.9x	1	x	2.68	x	92.28	x	0.63	x	0.7	=	75.58	(76)
East	0.9x	1	x	2.68	x	92.28	x	0.63	x	0.7	=	75.58	(76)
East	0.9x	1	x	2.68	x	113.09	x	0.63	x	0.7	=	92.63	(76)
East	0.9x	1	x	2.68	x	113.09	x	0.63	x	0.7	=	92.63	(76)
East	0.9x	1	x	2.68	x	113.09	x	0.63	x	0.7	=	92.63	(76)
East	0.9x	1	x	2.68	x	115.77	x	0.63	x	0.7	=	94.82	(76)
East	0.9x	1	x	2.68	x	115.77	x	0.63	x	0.7	=	94.82	(76)
East	0.9x	1	x	2.68	x	115.77	x	0.63	x	0.7	=	94.82	(76)
East	0.9x	1	x	2.68	x	110.22	x	0.63	x	0.7	=	90.27	(76)
East	0.9x	1	x	2.68	x	110.22	x	0.63	x	0.7	=	90.27	(76)
East	0.9x	1	x	2.68	x	110.22	x	0.63	x	0.7	=	90.27	(76)
East	0.9x	1	x	2.68	x	94.68	x	0.63	x	0.7	=	77.54	(76)
East	0.9x	1	x	2.68	x	94.68	x	0.63	x	0.7	=	77.54	(76)
East	0.9x	1	x	2.68	x	94.68	x	0.63	x	0.7	=	77.54	(76)
East	0.9x	1	x	2.68	x	73.59	x	0.63	x	0.7	=	60.27	(76)
East	0.9x	1	x	2.68	x	73.59	x	0.63	x	0.7	=	60.27	(76)
East	0.9x	1	x	2.68	x	73.59	x	0.63	x	0.7	=	60.27	(76)
East	0.9x	1	x	2.68	x	45.59	x	0.63	x	0.7	=	37.34	(76)
East	0.9x	1	x	2.68	x	45.59	x	0.63	x	0.7	=	37.34	(76)
East	0.9x	1	x	2.68	x	45.59	x	0.63	x	0.7	=	37.34	(76)
East	0.9x	1	x	2.68	x	24.49	x	0.63	x	0.7	=	20.06	(76)
East	0.9x	1	x	2.68	x	24.49	x	0.63	x	0.7	=	20.06	(76)
East	0.9x	1	x	2.68	x	24.49	x	0.63	x	0.7	=	20.06	(76)
East	0.9x	1	x	2.68	x	16.15	x	0.63	x	0.7	=	13.23	(76)
East	0.9x	1	x	2.68	x	16.15	x	0.63	x	0.7	=	13.23	(76)
East	0.9x	1	x	2.68	x	16.15	x	0.63	x	0.7	=	13.23	(76)
South	0.9x	0.77	x	4.47	x	46.75	x	0.63	x	0.7	=	63.87	(78)
South	0.9x	0.77	x	4.47	x	76.57	x	0.63	x	0.7	=	104.6	(78)
South	0.9x	0.77	x	4.47	x	97.53	x	0.63	x	0.7	=	133.24	(78)
South	0.9x	0.77	x	4.47	x	110.23	x	0.63	x	0.7	=	150.59	(78)
South	0.9x	0.77	x	4.47	x	114.87	x	0.63	x	0.7	=	156.92	(78)
South	0.9x	0.77	x	4.47	x	110.55	x	0.63	x	0.7	=	151.02	(78)
South	0.9x	0.77	x	4.47	x	108.01	x	0.63	x	0.7	=	147.55	(78)
South	0.9x	0.77	x	4.47	x	104.89	x	0.63	x	0.7	=	143.3	(78)
South	0.9x	0.77	x	4.47	x	101.89	x	0.63	x	0.7	=	139.18	(78)
South	0.9x	0.77	x	4.47	x	82.59	x	0.63	x	0.7	=	112.82	(78)

South	0.9x	0.77	x	4.47	x	55.42	x	0.63	x	0.7	=	75.7	(78)
South	0.9x	0.77	x	4.47	x	40.4	x	0.63	x	0.7	=	55.19	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	112.13	199	288.71	377.33	434.81	435.48	418.37	375.93	320	224.84	135.88	94.87	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	460.07	545.16	624.09	695.41	735.52	719.27	691.05	653.75	606.61	528.92	460.05	433.93	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.88	0.73	0.55	0.4	0.44	0.68	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.19	20.46	20.75	20.92	20.99	21	21	20.96	20.72	20.3	19.96	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20	20	20.01	20.02	20.02	20.02	20.03	20.02	20.02	20.01	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.85	0.68	0.47	0.31	0.35	0.6	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.68	18.96	19.34	19.74	19.95	20.02	20.02	20.02	19.99	19.71	19.13	18.63	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.34	19.57	19.9	20.24	20.43	20.5	20.51	20.51	20.48	20.22	19.71	19.3	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.34	19.57	19.9	20.24	20.43	20.5	20.51	20.51	20.48	20.22	19.71	19.3	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.94	0.85	0.7	0.51	0.35	0.39	0.63	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	455.01	531.53	586.94	594.2	516.39	364.49	244.41	255.99	384.84	472.58	449.18	430.26	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	970.14	944.41	860.2	719.56	552.92	369.78	245.04	257.07	401.2	608.74	802.19	964.41	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	383.26	277.45	203.31	90.26	27.18	0	0	0	0	101.3	254.17	397.4	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 1734.33 (98)

Space heating requirement in kWh/m²/year 29.65 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	383.26	277.45	203.31	90.26	27.18	0	0	0	0	101.3	254.17	397.4		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	409.9	296.74	217.44	96.53	29.07	0	0	0	0	108.34	271.84	425.03		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1854.9	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	177.5	156.58	164.74	148.1	145.43	130.38	125.63	137.28	136.86	153.55	161.84	173.37		
Efficiency of water heater													79.8	(216)
(217)m=	86.82	86.32	85.38	83.54	81.31	79.8	79.8	79.8	79.8	83.74	86.01	86.96		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	204.46	181.38	192.96	177.27	178.85	163.38	157.42	172.03	171.51	183.37	188.15	199.37		
Total = Sum(219a)$_{1...12}$ =													2170.17	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1854.9	
Water heating fuel used			2170.17	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			266.74	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	400.66	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	468.76	(264)
Space and water heating	(261) + (262) + (263) + (264) =				869.42	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	138.44	(268)

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Total CO2, kg/year	sum of (265)…(271) =	1046.78	(272)
TER =		17.89	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-11-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	49.58	(1a) x	2.4	(2a) =	118.99	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.58	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	118.99	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			6.8	x1/[1/(1.2)+ 0.04]		=	7.79			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	33.04	13.24	19.8	x	0.18	=	3.56			(29)
Walls Type2	23.89	2.1	21.79	x	0.18	=	3.92			(29)
Total area of elements, m²			56.93							(31)
Party wall			15.1	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.42 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 34.59 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	54.22	

Average = Sum(39)$_{1…12}$ /12= 54.22 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09

Average = $Sum(40)_{1...12}$ /12= 1.09 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.68 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	81.45	78.49	75.53	72.57	69.6	66.64	66.64	69.6	72.57	75.53	78.49	81.45	
Total = $Sum(44)_{1...12}$ = 888.56													(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	120.79	105.64	109.01	95.04	91.19	78.69	72.92	83.68	84.68	98.68	107.72	116.98	
Total = $Sum(45)_{1...12}$ = 1165.04													(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.12	15.85	16.35	14.26	13.68	11.8	10.94	12.55	12.7	14.8	16.16	17.55	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	176.07	155.57	164.29	148.54	146.47	132.19	128.2	138.96	138.17	153.96	161.21	172.25	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	176.07	155.57	164.29	148.54	146.47	132.19	128.2	138.96	138.17	153.96	161.21	172.25	

Output from water heater (annual)$_{1...12}$ | 1815.88 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.38	75.07	80.47	74.4	74.54	68.96	68.47	72.04	70.95	77.03	78.61	83.12	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	13.03	11.57	9.41	7.12	5.33	4.5	4.86	6.32	8.48	10.76	12.56	13.39	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	146.14	147.66	143.84	135.7	125.43	115.78	109.33	107.82	111.64	119.77	130.04	139.69	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	(71)
Water heating gains (Table 5)													
(72)m=	113.42	111.71	108.16	103.33	100.19	95.78	92.03	96.83	98.54	103.54	109.18	111.72	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	320.76	319.11	309.57	294.32	279.12	264.22	254.38	259.13	266.82	282.24	299.95	312.97	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)

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South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	6.8	x	19.64	x	0.5	x	0.8	=	37.02	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	6.8	x	38.42	x	0.5	x	0.8	=	72.42	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	6.8	x	63.27	x	0.5	x	0.8	=	119.27	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	6.8	x	92.28	x	0.5	x	0.8	=	173.94	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	6.8	x	113.09	x	0.5	x	0.8	=	213.18	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	6.8	x	115.77	x	0.5	x	0.8	=	218.22	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	6.8	x	110.22	x	0.5	x	0.8	=	207.76	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	6.8	x	94.68	x	0.5	x	0.8	=	178.46	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	6.8	x	73.59	x	0.5	x	0.8	=	138.71	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	6.8	x	45.59	x	0.5	x	0.8	=	85.93	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	6.8	x	24.49	x	0.5	x	0.8	=	46.16	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)

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West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	6.8	x	16.15	x	0.5	x	0.8	=	30.44	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	85.91	160.47	249.7	347.84	415.97	422.23	403.39	352.68	284.51	186.19	105.65	71.64	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	406.67	479.57	559.27	642.16	695.09	686.45	657.77	611.82	551.34	468.43	405.61	384.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.85	0.68	0.5	0.36	0.41	0.65	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.23	20.51	20.79	20.94	20.99	21	21	20.97	20.73	20.32	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.81	0.62	0.42	0.28	0.32	0.57	0.87	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.75	19.02	19.41	19.78	19.96	20	20.01	20.01	19.98	19.72	19.15	18.67	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.39	19.62	19.96	20.28	20.45	20.5	20.5	20.5	20.48	20.23	19.74	19.33	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.39	19.62	19.96	20.28	20.45	20.5	20.5	20.5	20.48	20.23	19.74	19.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.93	0.82	0.65	0.46	0.32	0.36	0.61	0.88	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	401.33	465.69	519.16	528.15	451.93	316.5	211.19	221.66	333.81	412.87	394.54	380.7	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	818.31	798.33	729.7	617.17	474.41	319.66	211.57	222.37	345.65	522.03	685.13	820.36	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	310.23	223.53	156.64	64.1	16.73	0	0	0	0	81.22	209.23	327.11	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 1388.78 (98)

Space heating requirement in kWh/m²/year 28.01 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1388.78	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1093.66	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	364.55	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1815.88	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1430	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	476.67	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	33.65	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		32.08	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	32.08	(331)
Energy for lighting (calculated in Appendix L)		230.09	(332)

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12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	2878.06	x	0.22	621.66	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	920.98	x	0.52	-477.99	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	3763.17	x	0.22	812.84	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1204.21	x	0.52	-624.99	(366)

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Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	195.38	(368)
Electrical energy for heat distribution	[(313) x	0.52	=	17.46	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	544.37	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			544.37	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	16.65	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	119.42	(379)
Total CO2, kg/year	sum of (376)…(382) =			680.44	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			13.72	(384)
EI rating (section 14)				90.36	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-11-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	49.58	(1a) x	2.4	(2a) =	118.99	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		118.99	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.43	x1/[1/(1.4)+ 0.04]		=	1.9			(27)
Windows Type 2			2.15	x1/[1/(1.4)+ 0.04]		=	2.85			(27)
Windows Type 3			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 4			1.43	x1/[1/(1.4)+ 0.04]		=	1.9			(27)
Walls Type1	33.04	10.3	22.74	x	0.18	=	4.09			(29)
Walls Type2	23.89	2.1	21.79	x	0.18	=	3.92			(29)
Total area of elements, m²			56.93							(31)
Party wall			15.1	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	23.77	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		7.22	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	30.99	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	23.66	23.51	23.35	22.63	22.5	21.87	21.87	21.76	22.11	22.5	22.77	23.06	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	54.66	54.5	54.35	53.63	53.49	52.86	52.86	52.75	53.1	53.49	53.76	54.05	

Average = Sum(39)$_{1…12}$ /12= 53.62 (39)

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Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	1.1	1.1	1.1	1.08	1.08	1.07	1.07	1.06	1.07	1.08	1.08	1.09

Average = Sum(40)$_{1...12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 1.68 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 74.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	81.45	78.49	75.53	72.57	69.6	66.64	66.64	69.6	72.57	75.53	78.49	81.45

Total = Sum(44)$_{1...12}$ = 888.56 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	120.79	105.64	109.01	95.04	91.19	78.69	72.92	83.68	84.68	98.68	107.72	116.98

Total = Sum(45)$_{1...12}$ = 1165.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.12	15.85	16.35	14.26	13.68	11.8	10.94	12.55	12.7	14.8	16.16	17.55

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.39 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) — 0.75 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	167.38	147.73	155.61	140.13	137.79	123.79	119.52	130.27	129.77	145.28	152.81	163.57	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	167.38	147.73	155.61	140.13	137.79	123.79	119.52	130.27	129.77	145.28	152.81	163.57	

Output from water heater (annual)$_{1...12}$ 1713.66 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.44	68.79	73.52	67.67	67.6	62.24	61.52	65.1	64.23	70.09	71.89	76.17	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	13.07	11.61	9.44	7.15	5.34	4.51	4.88	6.34	8.51	10.8	12.61	13.44	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	146.14	147.66	143.84	135.7	125.43	115.78	109.33	107.82	111.64	119.77	130.04	139.69	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	(71)
Water heating gains (Table 5)													
(72)m=	104.08	102.37	98.82	93.99	90.86	86.44	82.69	87.5	89.21	94.2	99.85	102.38	(72)
Total internal gains =						(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m							
(73)m=	314.47	312.81	303.27	288.01	272.8	257.9	248.07	252.82	260.52	275.94	293.66	306.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	1.43	x	46.75	x	0.63	x	0.7	=	20.43	(78)
South	0.9x	0.77	x	1.43	x	76.57	x	0.63	x	0.7	=	33.46	(78)
South	0.9x	0.77	x	1.43	x	97.53	x	0.63	x	0.7	=	42.62	(78)
South	0.9x	0.77	x	1.43	x	110.23	x	0.63	x	0.7	=	48.18	(78)
South	0.9x	0.77	x	1.43	x	114.87	x	0.63	x	0.7	=	50.2	(78)

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South	0.9x	0.77	x	1.43	x	110.55	x	0.63	x	0.7	=	48.31	(78)
South	0.9x	0.77	x	1.43	x	108.01	x	0.63	x	0.7	=	47.2	(78)
South	0.9x	0.77	x	1.43	x	104.89	x	0.63	x	0.7	=	45.84	(78)
South	0.9x	0.77	x	1.43	x	101.89	x	0.63	x	0.7	=	44.53	(78)
South	0.9x	0.77	x	1.43	x	82.59	x	0.63	x	0.7	=	36.09	(78)
South	0.9x	0.77	x	1.43	x	55.42	x	0.63	x	0.7	=	24.22	(78)
South	0.9x	0.77	x	1.43	x	40.4	x	0.63	x	0.7	=	17.66	(78)
West	0.9x	0.77	x	1.43	x	19.64	x	0.63	x	0.7	=	8.58	(80)
West	0.9x	0.77	x	2.15	x	19.64	x	0.63	x	0.7	=	12.9	(80)
West	0.9x	0.77	x	5.29	x	19.64	x	0.63	x	0.7	=	31.75	(80)
West	0.9x	0.77	x	1.43	x	38.42	x	0.63	x	0.7	=	16.79	(80)
West	0.9x	0.77	x	2.15	x	38.42	x	0.63	x	0.7	=	25.24	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.63	x	0.7	=	62.11	(80)
West	0.9x	0.77	x	1.43	x	63.27	x	0.63	x	0.7	=	27.65	(80)
West	0.9x	0.77	x	2.15	x	63.27	x	0.63	x	0.7	=	41.57	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.63	x	0.7	=	102.29	(80)
West	0.9x	0.77	x	1.43	x	92.28	x	0.63	x	0.7	=	40.33	(80)
West	0.9x	0.77	x	2.15	x	92.28	x	0.63	x	0.7	=	60.63	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.63	x	0.7	=	149.19	(80)
West	0.9x	0.77	x	1.43	x	113.09	x	0.63	x	0.7	=	49.42	(80)
West	0.9x	0.77	x	2.15	x	113.09	x	0.63	x	0.7	=	74.31	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.63	x	0.7	=	182.84	(80)
West	0.9x	0.77	x	1.43	x	115.77	x	0.63	x	0.7	=	50.59	(80)
West	0.9x	0.77	x	2.15	x	115.77	x	0.63	x	0.7	=	76.07	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.63	x	0.7	=	187.17	(80)
West	0.9x	0.77	x	1.43	x	110.22	x	0.63	x	0.7	=	48.17	(80)
West	0.9x	0.77	x	2.15	x	110.22	x	0.63	x	0.7	=	72.42	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.63	x	0.7	=	178.19	(80)
West	0.9x	0.77	x	1.43	x	94.68	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	2.15	x	94.68	x	0.63	x	0.7	=	62.21	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.63	x	0.7	=	153.06	(80)
West	0.9x	0.77	x	1.43	x	73.59	x	0.63	x	0.7	=	32.16	(80)
West	0.9x	0.77	x	2.15	x	73.59	x	0.63	x	0.7	=	48.35	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.63	x	0.7	=	118.97	(80)
West	0.9x	0.77	x	1.43	x	45.59	x	0.63	x	0.7	=	19.92	(80)
West	0.9x	0.77	x	2.15	x	45.59	x	0.63	x	0.7	=	29.96	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.63	x	0.7	=	73.7	(80)
West	0.9x	0.77	x	1.43	x	24.49	x	0.63	x	0.7	=	10.7	(80)
West	0.9x	0.77	x	2.15	x	24.49	x	0.63	x	0.7	=	16.09	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.63	x	0.7	=	39.59	(80)
West	0.9x	0.77	x	1.43	x	16.15	x	0.63	x	0.7	=	7.06	(80)

West	0.9x	0.77	x	2.15	x	16.15	x	0.63	x	0.7	=	10.61	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.63	x	0.7	=	26.11	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	73.67	137.61	214.14	298.33	356.77	362.14	345.98	302.49	244.01	159.67	90.6	61.44	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	388.14	450.42	517.42	586.34	629.57	620.04	594.05	555.31	504.53	435.62	384.27	368.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.88	0.73	0.54	0.39	0.43	0.68	0.92	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.17	20.44	20.75	20.93	20.99	21	21	20.96	20.71	20.29	19.96	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20	20	20.02	20.02	20.03	20.03	20.03	20.02	20.02	20.01	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.85	0.67	0.46	0.3	0.34	0.6	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.67	18.93	19.32	19.74	19.95	20.02	20.03	20.03	20	19.7	19.12	18.64	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.33	19.55	19.88	20.24	20.44	20.5	20.51	20.51	20.48	20.2	19.71	19.3	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.33	19.55	19.88	20.24	20.44	20.5	20.51	20.51	20.48	20.2	19.71	19.3	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.94	0.86	0.7	0.5	0.35	0.39	0.64	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	383.95	440.2	488.74	501.76	438.02	308.13	206.37	216.08	324.18	392.73	375.66	365	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	821.66	798.51	727.19	608.19	467.45	312.14	206.86	216.95	338.69	513.61	677.8	816.13	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	325.66	240.78	177.41	76.63	21.89	0	0	0	0	89.93	217.55	335.65	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1485.5 (98)

Space heating requirement in kWh/m²/year 29.96 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	325.66	240.78	177.41	76.63	21.89	0	0	0	0	89.93	217.55	335.65		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	348.3	257.52	189.74	81.96	23.42	0	0	0	0	96.19	232.67	358.98		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													1588.77	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	167.38	147.73	155.61	140.13	137.79	123.79	119.52	130.27	129.77	145.28	152.81	163.57		
Efficiency of water heater													79.8	(216)
(217)m=	86.56	86.11	85.16	83.28	81.11	79.8	79.8	79.8	79.8	83.58	85.76	86.69		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	193.37	171.56	182.72	168.27	169.87	155.12	149.77	163.25	162.62	173.82	178.2	188.68		
Total = Sum(219a)$_{1...12}$ =													2057.25	(219)

Annual totals

		kWh/year	kWh/year	
Space heating fuel used, main system 1			1588.77	
Water heating fuel used			2057.25	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			230.91	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	343.17	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	444.37	(264)
Space and water heating	(261) + (262) + (263) + (264) =			787.54	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	119.84	(268)

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Total CO2, kg/year	sum of (265)…(271) =	946.31	(272)
TER =		19.09	(273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-12-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.98	(1a) x	2.4	(2a) =	172.75	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		172.75	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 5			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	41.71	17.94	23.77	x	0.18	=	4.28			(29)
Walls Type2	11.24	2.1	9.14	x	0.18	=	1.65			(29)
Roof	34.4	0	34.4	x	0.11	=	3.78			(30)
Total area of elements, m²			87.35							(31)
Party wall			43.65	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	32.77	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		16.47	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	49.24	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	77.75	77.75	77.75	77.75	77.75	77.75	77.75	77.75	77.75	77.75	77.75	77.75	

Average = $Sum(39)_{1...12}$ /12= 77.75 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	

Average = $Sum(40)_{1...12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.29 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.66 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	97.53	93.98	90.44	86.89	83.34	79.8	79.8	83.34	86.89	90.44	93.98	97.53	

Total = $Sum(44)_{1...12}$ = 1063.97 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.63	126.5	130.54	113.8	109.2	94.23	87.32	100.2	101.39	118.17	128.99	140.07	

Total = $Sum(45)_{1...12}$ = 1395.03 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.7	18.97	19.58	17.07	16.38	14.13	13.1	15.03	15.21	17.72	19.35	21.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.91	176.43	185.81	167.3	164.47	147.72	142.59	155.47	154.89	173.44	182.48	195.35	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.91	176.43	185.81	167.3	164.47	147.72	142.59	155.47	154.89	173.44	182.48	195.35

Output from water heater (annual)$_{1...12}$ | 2045.87 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.31	82	87.62	80.63	80.53	74.13	73.25	77.54	76.51	83.51	85.68	90.8	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18	15.98	13	9.84	7.36	6.21	6.71	8.72	11.71	14.87	17.35	18.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	201.87	203.97	198.69	187.45	173.27	159.93	151.03	148.93	154.21	165.45	179.63	192.97	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	(71)

Water heating gains (Table 5)

(72)m=	124.08	122.03	117.77	111.99	108.24	102.95	98.46	104.22	106.26	112.25	119	122.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	401.34	399.38	386.86	366.68	346.26	326.49	313.59	319.27	329.58	349.96	373.39	390.9	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)

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North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
East	0.9x	1	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(76)
East	0.9x	1	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(76)
East	0.9x	1	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(76)
East	0.9x	1	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(76)
East	0.9x	1	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(76)
East	0.9x	1	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(76)
East	0.9x	1	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(76)
East	0.9x	1	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(76)
East	0.9x	1	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(76)
East	0.9x	1	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(76)
East	0.9x	1	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(76)
East	0.9x	1	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	66.09	127.6	213.87	329.81	427.83	450.24	423.48	346.58	253.49	151.67	81.91	54.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	467.43	526.98	600.73	696.49	774.09	776.73	737.08	665.85	583.07	501.63	455.3	445.67	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.81	0.62	0.46	0.53	0.8	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.9	20.04	20.29	20.62	20.87	20.98	21	20.99	20.91	20.57	20.17	19.86	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.76	0.53	0.36	0.42	0.73	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.55	18.75	19.12	19.58	19.9	20	20.02	20.01	19.95	19.53	18.95	18.5	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.09	19.27	19.59	20	20.29	20.39	20.41	20.4	20.33	19.94	19.44	19.04	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.09	19.27	19.59	20	20.29	20.39	20.41	20.4	20.33	19.94	19.44	19.04	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.92	0.77	0.57	0.4	0.46	0.75	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	465.04	521.68	584.98	637.94	598.35	439.32	294.6	308.36	439.81	477.35	450.59	443.87	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1150.01	1117.02	1017.51	862.64	667.79	450.28	296.03	311.37	484.58	726.49	959.09	1153.96	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	509.61	400.07	321.8	161.78	51.66	0	0	0	0	185.36	366.12	528.31	

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2524.71	(98)
Space heating requirement in kWh/m²/year		35.08	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2524.71	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1988.21	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	662.74	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2045.87	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1611.12	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	537.04	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	47.99	(313)

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Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.58	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	46.58	(331)
Energy for lighting (calculated in Appendix L)		317.84	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	5232.14	x	0.22		1130.14	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1674.28	x	0.52		-868.95	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4239.79	x	0.22		915.8	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1356.73	x	0.52		-704.15	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	278.66	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	24.91	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	776.4	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					776.4	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	24.17	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	164.96	(379)
Total CO2, kg/year	sum of (376)…(382) =					965.53	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					13.41	(384)
EI rating (section 14)						88.94	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b2-12-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.98	(1a) x	2.4	(2a) =	172.75	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.98	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	172.75	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.69	x1/[1/(1.4)+ 0.04]		=	6.22			(27)
Windows Type 2			2.45	x1/[1/(1.4)+ 0.04]		=	3.25			(27)
Windows Type 3			2.45	x1/[1/(1.4)+ 0.04]		=	3.25			(27)
Windows Type 4			4.69	x1/[1/(1.4)+ 0.04]		=	6.22			(27)
Windows Type 5			1.63	x1/[1/(1.4)+ 0.04]		=	2.16			(27)
Walls Type1	41.71	15.91	25.8	x	0.18	=	4.64			(29)
Walls Type2	11.24	2.1	9.14	x	0.18	=	1.65			(29)
Roof	34.4	0	34.4	x	0.13	=	4.47			(30)
Total area of elements, m²			87.35							(31)
Party wall			43.65	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	33.95	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		17.44	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	51.39	(37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.51	34.28	34.05	32.98	32.78	31.84	31.84	31.67	32.2	32.78	33.18	33.61	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	85.91	85.67	85.45	84.37	84.17	83.23	83.23	83.06	83.59	84.17	84.58	85	

Average = Sum(39)$_{1…12}$ /12= 84.37 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.19	1.19	1.19	1.17	1.17	1.16	1.16	1.15	1.16	1.17	1.17	1.18	

Average = Sum(40)$_{1…12}$ /12= 1.17 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.29 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.66 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	97.53	93.98	90.44	86.89	83.34	79.8	79.8	83.34	86.89	90.44	93.98	97.53	

Total = Sum(44)$_{1…12}$ = 1063.97 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.63	126.5	130.54	113.8	109.2	94.23	87.32	100.2	101.39	118.17	128.99	140.07	

Total = Sum(45)$_{1…12}$ = 1395.03 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.7	18.97	19.58	17.07	16.38	14.13	13.1	15.03	15.21	17.72	19.35	21.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.23	168.58	177.13	158.9	155.79	139.32	133.91	146.79	146.49	164.76	174.08	186.67	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.23	168.58	177.13	158.9	155.79	139.32	133.91	146.79	146.49	164.76	174.08	186.67

Output from water heater (annual)$_{1…12}$ — 1943.65 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.37	75.73	80.68	73.91	73.58	67.4	66.31	70.59	69.79	76.57	78.96	83.85	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18	15.99	13	9.84	7.36	6.21	6.71	8.73	11.71	14.87	17.36	18.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	201.87	203.97	198.69	187.45	173.27	159.93	151.03	148.93	154.21	165.45	179.63	192.97	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	(71)

Water heating gains (Table 5)

(72)m=	114.74	112.69	108.44	102.66	98.9	93.62	89.12	94.88	96.93	102.91	109.67	112.7	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	395.01	393.05	380.53	360.35	339.93	320.16	307.26	312.93	323.24	343.63	367.06	384.57	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

TER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	4.69	x	10.63	x	0.63	x	0.7	=	15.24	(74)
North	0.9x	0.77	x	2.45	x	10.63	x	0.63	x	0.7	=	7.96	(74)
North	0.9x	0.77	x	2.45	x	10.63	x	0.63	x	0.7	=	7.96	(74)
North	0.9x	0.77	x	1.63	x	10.63	x	0.63	x	0.7	=	5.3	(74)
North	0.9x	0.77	x	4.69	x	20.32	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.45	x	20.32	x	0.63	x	0.7	=	15.22	(74)
North	0.9x	0.77	x	2.45	x	20.32	x	0.63	x	0.7	=	15.22	(74)
North	0.9x	0.77	x	1.63	x	20.32	x	0.63	x	0.7	=	10.12	(74)
North	0.9x	0.77	x	4.69	x	34.53	x	0.63	x	0.7	=	49.49	(74)
North	0.9x	0.77	x	2.45	x	34.53	x	0.63	x	0.7	=	25.85	(74)
North	0.9x	0.77	x	2.45	x	34.53	x	0.63	x	0.7	=	25.85	(74)
North	0.9x	0.77	x	1.63	x	34.53	x	0.63	x	0.7	=	17.2	(74)
North	0.9x	0.77	x	4.69	x	55.46	x	0.63	x	0.7	=	79.5	(74)
North	0.9x	0.77	x	2.45	x	55.46	x	0.63	x	0.7	=	41.53	(74)
North	0.9x	0.77	x	2.45	x	55.46	x	0.63	x	0.7	=	41.53	(74)
North	0.9x	0.77	x	1.63	x	55.46	x	0.63	x	0.7	=	27.63	(74)
North	0.9x	0.77	x	4.69	x	74.72	x	0.63	x	0.7	=	107.09	(74)
North	0.9x	0.77	x	2.45	x	74.72	x	0.63	x	0.7	=	55.94	(74)
North	0.9x	0.77	x	2.45	x	74.72	x	0.63	x	0.7	=	55.94	(74)
North	0.9x	0.77	x	1.63	x	74.72	x	0.63	x	0.7	=	37.22	(74)
North	0.9x	0.77	x	4.69	x	79.99	x	0.63	x	0.7	=	114.65	(74)
North	0.9x	0.77	x	2.45	x	79.99	x	0.63	x	0.7	=	59.89	(74)
North	0.9x	0.77	x	2.45	x	79.99	x	0.63	x	0.7	=	59.89	(74)
North	0.9x	0.77	x	1.63	x	79.99	x	0.63	x	0.7	=	39.84	(74)
North	0.9x	0.77	x	4.69	x	74.68	x	0.63	x	0.7	=	107.04	(74)
North	0.9x	0.77	x	2.45	x	74.68	x	0.63	x	0.7	=	55.91	(74)
North	0.9x	0.77	x	2.45	x	74.68	x	0.63	x	0.7	=	55.91	(74)
North	0.9x	0.77	x	1.63	x	74.68	x	0.63	x	0.7	=	37.2	(74)
North	0.9x	0.77	x	4.69	x	59.25	x	0.63	x	0.7	=	84.92	(74)
North	0.9x	0.77	x	2.45	x	59.25	x	0.63	x	0.7	=	44.36	(74)
North	0.9x	0.77	x	2.45	x	59.25	x	0.63	x	0.7	=	44.36	(74)
North	0.9x	0.77	x	1.63	x	59.25	x	0.63	x	0.7	=	29.51	(74)
North	0.9x	0.77	x	4.69	x	41.52	x	0.63	x	0.7	=	59.51	(74)
North	0.9x	0.77	x	2.45	x	41.52	x	0.63	x	0.7	=	31.09	(74)
North	0.9x	0.77	x	2.45	x	41.52	x	0.63	x	0.7	=	31.09	(74)
North	0.9x	0.77	x	1.63	x	41.52	x	0.63	x	0.7	=	20.68	(74)
North	0.9x	0.77	x	4.69	x	24.19	x	0.63	x	0.7	=	34.67	(74)
North	0.9x	0.77	x	2.45	x	24.19	x	0.63	x	0.7	=	18.11	(74)
North	0.9x	0.77	x	2.45	x	24.19	x	0.63	x	0.7	=	18.11	(74)
North	0.9x	0.77	x	1.63	x	24.19	x	0.63	x	0.7	=	12.05	(74)
North	0.9x	0.77	x	4.69	x	13.12	x	0.63	x	0.7	=	18.8	(74)

North	0.9x	0.77	x	2.45	x	13.12	x	0.63	x	0.7	=	9.82	(74)
North	0.9x	0.77	x	2.45	x	13.12	x	0.63	x	0.7	=	9.82	(74)
North	0.9x	0.77	x	1.63	x	13.12	x	0.63	x	0.7	=	6.53	(74)
North	0.9x	0.77	x	4.69	x	8.86	x	0.63	x	0.7	=	12.71	(74)
North	0.9x	0.77	x	2.45	x	8.86	x	0.63	x	0.7	=	6.64	(74)
North	0.9x	0.77	x	2.45	x	8.86	x	0.63	x	0.7	=	6.64	(74)
North	0.9x	0.77	x	1.63	x	8.86	x	0.63	x	0.7	=	4.42	(74)
East	0.9x	1	x	4.69	x	19.64	x	0.63	x	0.7	=	28.15	(76)
East	0.9x	1	x	4.69	x	38.42	x	0.63	x	0.7	=	55.07	(76)
East	0.9x	1	x	4.69	x	63.27	x	0.63	x	0.7	=	90.69	(76)
East	0.9x	1	x	4.69	x	92.28	x	0.63	x	0.7	=	132.27	(76)
East	0.9x	1	x	4.69	x	113.09	x	0.63	x	0.7	=	162.1	(76)
East	0.9x	1	x	4.69	x	115.77	x	0.63	x	0.7	=	165.94	(76)
East	0.9x	1	x	4.69	x	110.22	x	0.63	x	0.7	=	157.98	(76)
East	0.9x	1	x	4.69	x	94.68	x	0.63	x	0.7	=	135.7	(76)
East	0.9x	1	x	4.69	x	73.59	x	0.63	x	0.7	=	105.48	(76)
East	0.9x	1	x	4.69	x	45.59	x	0.63	x	0.7	=	65.34	(76)
East	0.9x	1	x	4.69	x	24.49	x	0.63	x	0.7	=	35.1	(76)
East	0.9x	1	x	4.69	x	16.15	x	0.63	x	0.7	=	23.15	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	64.61	124.75	209.09	322.45	418.3	440.2	414.04	338.86	247.84	148.29	80.08	53.55	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	459.63	517.8	589.62	682.8	758.22	760.37	721.3	651.79	571.08	491.92	447.14	438.11	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.95	0.85	0.66	0.5	0.57	0.84	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.74	19.88	20.15	20.52	20.82	20.96	20.99	20.99	20.87	20.48	20.05	19.71	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.93	19.93	19.94	19.94	19.96	19.96	19.96	19.95	19.94	19.94	19.94	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.79	0.57	0.39	0.45	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.25	18.46	18.85	19.38	19.77	19.93	19.95	19.95	19.85	19.35	18.72	18.22	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.84	19.03	19.37	19.83	20.19	20.34	20.37	20.36	20.26	19.8	19.25	18.82	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.84	19.03	19.37	19.83	20.19	20.34	20.37	20.36	20.26	19.8	19.25	18.82	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.81	0.6	0.43	0.5	0.79	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	457.41	513.1	576.39	634.78	611.48	459.4	310.87	323.9	449.41	471.67	442.97	436.43	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1249.4	1210.46	1099.6	922.57	714.37	477.92	313.63	329.31	514.76	774.55	1027.72	1242.73	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	589.24	468.62	389.27	207.21	76.55	0	0	0	0	225.34	421.02	599.88	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2977.14 (98)

Space heating requirement in kWh/m²/year 41.36 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	589.24	468.62	389.27	207.21	76.55	0	0	0	0	225.34	421.02	599.88	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	630.2	501.2	416.33	221.61	81.87	0	0	0	0	241.01	450.29	641.59	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3184.1 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	191.23	168.58	177.13	158.9	155.79	139.32	133.91	146.79	146.49	164.76	174.08	186.67

Efficiency of water heater 79.8 (216)

(217)m=	87.62	87.4	86.86	85.52	83.03	79.8	79.8	79.8	79.8	85.65	87.08	87.71	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	218.25	192.89	203.93	185.79	187.62	174.59	167.81	183.95	183.57	192.37	199.9	212.82

Total = Sum(219a)$_{1...12}$ = 2303.48 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3184.1

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Water heating fuel used			2303.48	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			317.9	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	687.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	497.55	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1185.32	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	164.99	(268)
Total CO2, kg/year		sum of (265)…(271) =		1389.23	(272)
TER =				19.3	(273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-12-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	110.51	(1a) x	2.4	(2a) =	265.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	110.51	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	265.22	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.1	x	1.2	=	2.52			(26)
Doors Type 2			2.1	x	1.2	=	2.52			(26)
Windows Type 1			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 2			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 6			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	58.45	20.24	38.21	x	0.18	=	6.88			(29)
Walls Type2	49.58	4.2	45.38	x	0.18	=	8.17			(29)
Roof	21.55	0	21.55	x	0.11	=	2.37			(30)
Total area of elements, m²			129.58							(31)
Party wall			22.08	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 45.63 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 21.46 (36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	67.1	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	43.76	43.76	43.76	43.76	43.76	43.76	43.76	43.76	43.76	43.76	43.76	43.76	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	110.86	110.86	110.86	110.86	110.86	110.86	110.86	110.86	110.86	110.86	110.86	110.86	

Average = Sum(39)$_{1...12}$ /12= 110.86 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	1	1	1	1	1	1	1	1	1	1	1	

Average = Sum(40)$_{1...12}$ /12= 1 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.82 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 101.12 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	111.24	107.19	103.15	99.1	95.06	91.01	91.01	95.06	99.1	103.15	107.19	111.24	

Total = Sum(44)$_{1...12}$ = 1213.49 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	164.96	144.28	148.88	129.8	124.54	107.47	99.59	114.28	115.64	134.77	147.11	159.76	

Total = Sum(45)$_{1...12}$ = 1591.07 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.74	21.64	22.33	19.47	18.68	16.12	14.94	17.14	17.35	20.22	22.07	23.96	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		0	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)			
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)			
Water storage loss:			
a) If manufacturer’s declared loss factor is known (kWh/day):		0	(48)
Temperature factor from Table 2b		0	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	110	(50)
b) If manufacturer’s declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0.02	(51)
If community heating see section 4.3			
Volume factor from Table 2a		1.03	(52)
Temperature factor from Table 2b		0.6	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	1.03	(54)
Enter (50) or (54) in (55)		1.03	(55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	220.24	194.2	204.16	183.29	179.82	160.96	154.86	169.56	169.14	190.05	200.61	215.03	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	220.24	194.2	204.16	183.29	179.82	160.96	154.86	169.56	169.14	190.05	200.61	215.03	

Output from water heater (annual)$_{1...12}$ | 2241.91 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	99.07	87.91	93.72	85.95	85.63	78.53	77.33	82.22	81.25	89.03	91.71	97.34	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	24.35	21.62	17.59	13.31	9.95	8.4	9.08	11.8	15.84	20.11	23.47	25.02	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	272.29	275.11	267.99	252.83	233.7	215.72	203.7	200.88	208	223.16	242.29	260.27	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	(71)

Water heating gains (Table 5)

(72)m=	133.16	130.82	125.97	119.38	115.1	109.07	103.94	110.51	112.84	119.67	127.38	130.83	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	495.06	492.83	476.82	450.79	424.02	398.45	381.99	388.46	401.95	428.2	458.41	481.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)

East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	144.76	264.2	398.68	540.63	636.78	642.87	615.57	544.21	448.96	302.95	176.83	121.53	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	639.82	757.03	875.5	991.43	1060.79	1041.33	997.56	932.67	850.9	731.16	635.24	602.93	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	1	1	0.98	0.94	0.84	0.65	0.48	0.54	0.8	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.94	20.1	20.35	20.65	20.87	20.98	21	20.99	20.93	20.61	20.21	19.9	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.79	0.57	0.39	0.44	0.73	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.66	18.89	19.25	19.67	19.96	20.06	20.08	20.08	20.02	19.63	19.05	18.6	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.04	19.25	19.58	19.96	20.23	20.34	20.35	20.35	20.29	19.93	19.4	18.99	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.04	19.25	19.58	19.96	20.23	20.34	20.35	20.35	20.29	19.93	19.4	18.99	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.92	0.8	0.6	0.42	0.47	0.75	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	637.81	750.86	854.35	915.22	844.78	619.9	414.39	434.79	634.24	697.1	630.55	601.54	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1634.5	1591.16	1450.14	1226.38	946.15	636.07	416.19	438.15	686.71	1033.79	1363.07	1639.49	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	741.54	564.68	443.27	224.03	75.42	0	0	0	0	250.49	527.42	772.23	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3599.09 (98)

Space heating requirement in kWh/m²/year 32.57 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)

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Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		3599.09	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	2834.28	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	944.76	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2241.91	
If DHW from community scheme:			
Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1765.51	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	588.5	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	61.33	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		71.51	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	71.51	(331)
Energy for lighting (calculated in Appendix L)		429.97	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	7458.63	x	0.22		1611.06	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	2386.76	x	0.52		-1238.73	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4646.07	x	0.22		1003.55	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1486.74	x	0.52		-771.62	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	356.11	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	31.83	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	992.21	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					992.21	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	37.11	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	223.16	(379)
Total CO2, kg/year	sum of (376)…(382) =			1252.48	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			11.33	(384)
EI rating (section 14)				89.21	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-12-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	110.51	(1a) x	2.4	(2a) =	265.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	110.51	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	265.22	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.43	0.42	0.37	0.37	0.32	0.32	0.32	0.34	0.37	0.38	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.1	x	1	=	2.1			(26)
Doors Type 2			2.1	x	1	=	2.1			(26)
Windows Type 1			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 2			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 5			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 6			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	58.45	20.24	38.21	x	0.18	=	6.88			(29)
Walls Type2	49.58	4.2	45.38	x	0.18	=	8.17			(29)
Roof	21.55	0	21.55	x	0.13	=	2.8			(30)
Total area of elements, m²			129.58							(31)
Party wall			22.08	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	48.88	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	23.85	(36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 72.73 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	52.02	51.7	51.38	49.91	49.63	48.35	48.35	48.11	48.84	49.63	50.19	50.77	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	124.75	124.43	124.11	122.64	122.36	121.07	121.07	120.84	121.57	122.36	122.92	123.5	

Average = Sum(39)$_{1…12}$ /12= 122.63 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.13	1.13	1.12	1.11	1.11	1.1	1.1	1.09	1.1	1.11	1.11	1.12	

Average = Sum(40)$_{1…12}$ /12= 1.11 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.82 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 101.12 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	111.24	107.19	103.15	99.1	95.06	91.01	91.01	95.06	99.1	103.15	107.19	111.24	

Total = Sum(44)$_{1…12}$ = 1213.49 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	164.96	144.28	148.88	129.8	124.54	107.47	99.59	114.28	115.64	134.77	147.11	159.76	

Total = Sum(45)$_{1…12}$ = 1591.07 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.74	21.64	22.33	19.47	18.68	16.12	14.94	17.14	17.35	20.22	22.07	23.96	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.56	186.36	195.47	174.89	171.14	152.56	146.18	160.87	160.74	181.37	192.2	206.35	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.56	186.36	195.47	174.89	171.14	152.56	146.18	160.87	160.74	181.37	192.2	206.35	

Output from water heater (annual)$_{1\ldots12}$ | 2139.69 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.13	81.64	86.78	79.23	78.69	71.81	70.39	75.27	74.52	82.09	84.99	90.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	24.73	21.96	17.86	13.52	10.11	8.53	9.22	11.98	16.09	20.42	23.84	25.41	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	272.29	275.11	267.99	252.83	233.7	215.72	203.7	200.88	208	223.16	242.29	260.27	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	(71)

Water heating gains (Table 5)

(72)m=	123.82	121.49	116.64	110.04	105.76	99.73	94.61	101.17	103.51	110.33	118.04	121.5	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	489.1	486.83	470.76	444.67	417.84	392.25	375.8	382.3	395.86	422.18	452.44	475.45	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)

East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
South	0.9x	0.77	x	4.6	x	46.75	x	0.63	x	0.7	=	65.72	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.63	x	0.7	=	107.64	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.63	x	0.7	=	137.12	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.63	x	0.7	=	154.97	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.63	x	0.7	=	161.49	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.63	x	0.7	=	155.41	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.63	x	0.7	=	151.85	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.63	x	0.7	=	147.46	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.63	x	0.7	=	143.23	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.63	x	0.7	=	116.1	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.63	x	0.7	=	77.91	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.63	x	0.7	=	56.79	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	159.6	291.28	439.55	596.05	702.05	708.77	678.67	599.99	494.97	334.01	194.96	133.99	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	648.71	778.11	910.3	1040.72	1119.88	1101.02	1054.46	982.3	890.83	756.19	647.39	609.44	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	1	1	0.98	0.95	0.84	0.67	0.5	0.55	0.81	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.78	19.95	20.23	20.57	20.84	20.96	20.99	20.99	20.9	20.54	20.09	19.75	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.98	19.98	19.99	19.99	20	20	20.01	20	19.99	19.99	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.79	0.58	0.39	0.44	0.74	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.34	18.6	19	19.5	19.84	19.98	20	20	19.92	19.46	18.81	18.31	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.77	19.01	19.37	19.82	20.14	20.28	20.3	20.3	20.22	19.78	19.19	18.74	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.77	19.01	19.37	19.82	20.14	20.28	20.3	20.3	20.22	19.78	19.19	18.74	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.92	0.8	0.6	0.42	0.47	0.75	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	646.46	771.29	887.62	960.93	898.47	664.02	444.96	465.73	672.5	721.43	642.36	607.89	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1805.35	1755.1	1597.5	1339.16	1032.35	687.27	447.91	471.02	743.66	1123.84	1486.69	1795.59	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	862.21	661.12	528.15	272.33	99.61	0	0	0	0	299.39	607.91	883.65	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4214.37 (98)

Space heating requirement in kWh/m²/year 38.14 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	862.21	661.12	528.15	272.33	99.61	0	0	0	0	299.39	607.91	883.65	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	922.15	707.08	564.87	291.26	106.54	0	0	0	0	320.2	650.17	945.08	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 4507.35 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
								Total (kWh/year) =Sum(215)$_{1...5,10...12}$=					0	(215)

Water heating

Output from water heater (calculated above)

	211.56	186.36	195.47	174.89	171.14	152.56	146.18	160.87	160.74	181.37	192.2	206.35		
Efficiency of water heater													79.8	(216)
(217)m=	88.17	87.91	87.34	85.99	83.43	79.8	79.8	79.8	79.8	86.14	87.68	88.26		(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	239.94	212	223.82	203.38	205.13	191.18	183.19	201.6	201.42	210.54	219.22	233.8		
								Total = Sum(219a)$_{1...12}$ =					2525.21	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			4507.35	
Water heating fuel used			2525.21	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			436.67	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	973.59	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	545.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1519.03	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	226.63	(268)
Total CO2, kg/year		sum of (265)…(271) =		1784.59	(272)

TER =	16.15	(273)

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User Details:

Assessor Name: | **Stroma Number:**

Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-12-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	49.58	(1a) x	2.4	(2a) =	118.99	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.58	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	118.99	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			6.8	x1/[1/(1.2)+ 0.04]		=	7.79			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 4			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	33.04	13.24	19.8	x	0.18	=	3.56			(29)
Walls Type2	23.89	2.1	21.79	x	0.18	=	3.92			(29)
Roof	5.9	0	5.9	x	0.11	=	0.65			(30)
Total area of elements, m²			62.83							(31)
Party wall			15.1	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	25.82	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		12.58	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	38.4	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	58.03	58.03	58.03	58.03	58.03	58.03	58.03	58.03	58.03	58.03	58.03	58.03	

Average = Sum(39)$_{1...12}$ /12= 58.03 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17

Average = Sum(40)$_{1...12}$ /12= 1.17 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.68 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	81.45	78.49	75.53	72.57	69.6	66.64	66.64	69.6	72.57	75.53	78.49	81.45

Total = Sum(44)$_{1...12}$ = 888.56 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	120.79	105.64	109.01	95.04	91.19	78.69	72.92	83.68	84.68	98.68	107.72	116.98

Total = Sum(45)$_{1...12}$ = 1165.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.12	15.85	16.35	14.26	13.68	11.8	10.94	12.55	12.7	14.8	16.16	17.55	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	176.07	155.57	164.29	148.54	146.47	132.19	128.2	138.96	138.17	153.96	161.21	172.25	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	176.07	155.57	164.29	148.54	146.47	132.19	128.2	138.96	138.17	153.96	161.21	172.25

Output from water heater (annual)$_{1...12}$	1815.88	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.38	75.07	80.47	74.4	74.54	68.96	68.47	72.04	70.95	77.03	78.61	83.12	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.03	11.57	9.41	7.12	5.33	4.5	4.86	6.32	8.48	10.76	12.56	13.39	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	146.14	147.66	143.84	135.7	125.43	115.78	109.33	107.82	111.64	119.77	130.04	139.69	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	(71)

Water heating gains (Table 5)

(72)m=	113.42	111.71	108.16	103.33	100.19	95.78	92.03	96.83	98.54	103.54	109.18	111.72	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	320.76	319.11	309.57	294.32	279.12	264.22	254.38	259.13	266.82	282.24	299.95	312.97	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)

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South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	6.8	x	19.64	x	0.5	x	0.8	=	37.02	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	6.8	x	38.42	x	0.5	x	0.8	=	72.42	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	6.8	x	63.27	x	0.5	x	0.8	=	119.27	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	6.8	x	92.28	x	0.5	x	0.8	=	173.94	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	6.8	x	113.09	x	0.5	x	0.8	=	213.18	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	6.8	x	115.77	x	0.5	x	0.8	=	218.22	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	6.8	x	110.22	x	0.5	x	0.8	=	207.76	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	6.8	x	94.68	x	0.5	x	0.8	=	178.46	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	6.8	x	73.59	x	0.5	x	0.8	=	138.71	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	6.8	x	45.59	x	0.5	x	0.8	=	85.93	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)

West	0.9x	0.77	x	6.8	x	24.49	x	0.5	x	0.8	=	46.16	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	6.8	x	16.15	x	0.5	x	0.8	=	30.44	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	85.91	160.47	249.7	347.84	415.97	422.23	403.39	352.68	284.51	186.19	105.65	71.64	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	406.67	479.57	559.27	642.16	695.09	686.45	657.77	611.82	551.34	468.43	405.61	384.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.87	0.71	0.53	0.39	0.43	0.68	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.13	20.42	20.73	20.92	20.98	21	21	20.95	20.67	20.23	19.88	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.94	19.94	19.94	19.94	19.94	19.94	19.94	19.94	19.94	19.94	19.94	19.94	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.83	0.65	0.45	0.29	0.34	0.59	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.55	18.82	19.24	19.65	19.87	19.93	19.94	19.94	19.91	19.59	18.98	18.47	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.24	19.48	19.83	20.19	20.39	20.46	20.47	20.47	20.43	20.13	19.6	19.18	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.24	19.48	19.83	20.19	20.39	20.46	20.47	20.47	20.43	20.13	19.6	19.18	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.84	0.68	0.49	0.34	0.38	0.63	0.89	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	401.54	466.65	522.92	539.53	471.31	334.65	223.85	234.8	349.33	418.35	395.27	380.81	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	866.93	845.77	773.29	654.95	504.49	340.01	224.58	236.1	367.31	553.18	725.63	869.12	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	346.25	254.77	186.28	83.1	24.69	0	0	0	0	100.31	237.86	363.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1596.57 (98)

Space heating requirement in kWh/m²/year 32.2 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1596.57	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1257.3	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	419.1	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1815.88	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1430	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	476.67	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	35.83	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		32.08	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	32.08	(331)
Energy for lighting (calculated in Appendix L)		230.09	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	3308.68	x	0.22	714.68	(363)

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less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1058.78	x	0.52		-549.51	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	3763.17	x	0.22		812.84	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1204.21	x	0.52		-624.99	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	208.05	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	18.6	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	579.67	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					579.67	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	16.65	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	119.42	(379)
Total CO2, kg/year	sum of (376)…(382) =					715.74	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					14.44	(384)
EI rating (section 14)						89.86	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-12-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	49.58	(1a)	x	2.4	(2a)	=	118.99	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.58	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			118.99	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.15	x1/[1/(1.4)+ 0.04]		=	2.85			(27)
Windows Type 2			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 3			1.43	x1/[1/(1.4)+ 0.04]		=	1.9			(27)
Windows Type 4			1.43	x1/[1/(1.4)+ 0.04]		=	1.9			(27)
Walls Type1	33.04	10.3	22.74	x	0.18	=	4.09			(29)
Walls Type2	23.89	2.1	21.79	x	0.18	=	3.92			(29)
Roof	5.9	0	5.9	x	0.13	=	0.77			(30)
Total area of elements, m²			62.83							(31)
Party wall			15.1	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	24.54	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		14.29	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	38.83	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	23.66	23.51	23.35	22.63	22.5	21.87	21.87	21.76	22.11	22.5	22.77	23.06	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	62.49	62.33	62.18	61.46	61.32	60.7	60.7	60.58	60.94	61.32	61.6	61.88	

Average = Sum(39)$_{1...12}$ /12= 61.46 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.26	1.26	1.25	1.24	1.24	1.22	1.22	1.22	1.23	1.24	1.24	1.25	

Average = Sum(40)$_{1...12}$ /12= 1.24 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.68 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	81.45	78.49	75.53	72.57	69.6	66.64	66.64	69.6	72.57	75.53	78.49	81.45	

Total = Sum(44)$_{1...12}$ = 888.56 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	120.79	105.64	109.01	95.04	91.19	78.69	72.92	83.68	84.68	98.68	107.72	116.98	

Total = Sum(45)$_{1...12}$ = 1165.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.12	15.85	16.35	14.26	13.68	11.8	10.94	12.55	12.7	14.8	16.16	17.55	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	167.38	147.73	155.61	140.13	137.79	123.79	119.52	130.27	129.77	145.28	152.81	163.57	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	167.38	147.73	155.61	140.13	137.79	123.79	119.52	130.27	129.77	145.28	152.81	163.57

Output from water heater (annual)1…12 | 1713.66 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.44	68.79	73.52	67.67	67.6	62.24	61.52	65.1	64.23	70.09	71.89	76.17	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.07	11.61	9.44	7.15	5.34	4.51	4.88	6.34	8.51	10.8	12.61	13.44	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	146.14	147.66	143.84	135.7	125.43	115.78	109.33	107.82	111.64	119.77	130.04	139.69	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	(71)

Water heating gains (Table 5)

(72)m=	104.08	102.37	98.82	93.99	90.86	86.44	82.69	87.5	89.21	94.2	99.85	102.38	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	314.47	312.81	303.27	288.01	272.8	257.9	248.07	252.82	260.52	275.94	293.66	306.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	1.43	x	46.75	x	0.63	x	0.7	=	20.43	(78)
South	0.9x	0.77	x	1.43	x	76.57	x	0.63	x	0.7	=	33.46	(78)

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South	0.9x	0.77	x	1.43	x	97.53	x	0.63	x	0.7	=	42.62	(78)
South	0.9x	0.77	x	1.43	x	110.23	x	0.63	x	0.7	=	48.18	(78)
South	0.9x	0.77	x	1.43	x	114.87	x	0.63	x	0.7	=	50.2	(78)
South	0.9x	0.77	x	1.43	x	110.55	x	0.63	x	0.7	=	48.31	(78)
South	0.9x	0.77	x	1.43	x	108.01	x	0.63	x	0.7	=	47.2	(78)
South	0.9x	0.77	x	1.43	x	104.89	x	0.63	x	0.7	=	45.84	(78)
South	0.9x	0.77	x	1.43	x	101.89	x	0.63	x	0.7	=	44.53	(78)
South	0.9x	0.77	x	1.43	x	82.59	x	0.63	x	0.7	=	36.09	(78)
South	0.9x	0.77	x	1.43	x	55.42	x	0.63	x	0.7	=	24.22	(78)
South	0.9x	0.77	x	1.43	x	40.4	x	0.63	x	0.7	=	17.66	(78)
West	0.9x	0.77	x	2.15	x	19.64	x	0.63	x	0.7	=	12.9	(80)
West	0.9x	0.77	x	5.29	x	19.64	x	0.63	x	0.7	=	31.75	(80)
West	0.9x	0.77	x	1.43	x	19.64	x	0.63	x	0.7	=	8.58	(80)
West	0.9x	0.77	x	2.15	x	38.42	x	0.63	x	0.7	=	25.24	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.63	x	0.7	=	62.11	(80)
West	0.9x	0.77	x	1.43	x	38.42	x	0.63	x	0.7	=	16.79	(80)
West	0.9x	0.77	x	2.15	x	63.27	x	0.63	x	0.7	=	41.57	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.63	x	0.7	=	102.29	(80)
West	0.9x	0.77	x	1.43	x	63.27	x	0.63	x	0.7	=	27.65	(80)
West	0.9x	0.77	x	2.15	x	92.28	x	0.63	x	0.7	=	60.63	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.63	x	0.7	=	149.19	(80)
West	0.9x	0.77	x	1.43	x	92.28	x	0.63	x	0.7	=	40.33	(80)
West	0.9x	0.77	x	2.15	x	113.09	x	0.63	x	0.7	=	74.31	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.63	x	0.7	=	182.84	(80)
West	0.9x	0.77	x	1.43	x	113.09	x	0.63	x	0.7	=	49.42	(80)
West	0.9x	0.77	x	2.15	x	115.77	x	0.63	x	0.7	=	76.07	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.63	x	0.7	=	187.17	(80)
West	0.9x	0.77	x	1.43	x	115.77	x	0.63	x	0.7	=	50.59	(80)
West	0.9x	0.77	x	2.15	x	110.22	x	0.63	x	0.7	=	72.42	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.63	x	0.7	=	178.19	(80)
West	0.9x	0.77	x	1.43	x	110.22	x	0.63	x	0.7	=	48.17	(80)
West	0.9x	0.77	x	2.15	x	94.68	x	0.63	x	0.7	=	62.21	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.63	x	0.7	=	153.06	(80)
West	0.9x	0.77	x	1.43	x	94.68	x	0.63	x	0.7	=	41.38	(80)
West	0.9x	0.77	x	2.15	x	73.59	x	0.63	x	0.7	=	48.35	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.63	x	0.7	=	118.97	(80)
West	0.9x	0.77	x	1.43	x	73.59	x	0.63	x	0.7	=	32.16	(80)
West	0.9x	0.77	x	2.15	x	45.59	x	0.63	x	0.7	=	29.96	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.63	x	0.7	=	73.7	(80)
West	0.9x	0.77	x	1.43	x	45.59	x	0.63	x	0.7	=	19.92	(80)
West	0.9x	0.77	x	2.15	x	24.49	x	0.63	x	0.7	=	16.09	(80)

West	0.9x	0.77	x	5.29	x	24.49	x	0.63	x	0.7	=	39.59	(80)
West	0.9x	0.77	x	1.43	x	24.49	x	0.63	x	0.7	=	10.7	(80)
West	0.9x	0.77	x	2.15	x	16.15	x	0.63	x	0.7	=	10.61	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.63	x	0.7	=	26.11	(80)
West	0.9x	0.77	x	1.43	x	16.15	x	0.63	x	0.7	=	7.06	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	73.67	137.61	214.14	298.33	356.77	362.14	345.98	302.49	244.01	159.67	90.6	61.44	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	388.14	450.42	517.42	586.34	629.57	620.04	594.05	555.31	504.53	435.62	384.27	368.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.91	0.78	0.6	0.44	0.49	0.74	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.78	19.96	20.25	20.61	20.86	20.97	20.99	20.99	20.92	20.58	20.11	19.75	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.87	19.87	19.88	19.89	19.89	19.9	19.9	19.9	19.9	19.89	19.89	19.88	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.88	0.72	0.51	0.34	0.38	0.66	0.92	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.27	18.54	18.96	19.45	19.76	19.88	19.9	19.9	19.84	19.42	18.77	18.23	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.03	19.25	19.61	20.03	20.31	20.43	20.45	20.44	20.38	20	19.44	18.99	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.03	19.25	19.61	20.03	20.31	20.43	20.45	20.44	20.38	20	19.44	18.99	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.88	0.75	0.55	0.39	0.44	0.7	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	384.14	441.24	493.17	517.52	469.77	342.8	231.82	242.28	351.47	400.38	376.55	365.08	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	920.19	894.49	814.98	683.95	527.86	353.58	233.46	245.02	382.44	576.45	760.08	915.25	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	398.82	304.59	239.43	119.83	43.22	0	0	0	0	131	276.14	409.33	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 1922.34 (98)

Space heating requirement in kWh/m²/year 38.77 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system			0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =		1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =		1	(204)
Efficiency of main space heating system 1			93.5	(206)
Efficiency of secondary/supplementary heating system, %			0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	398.82	304.59	239.43	119.83	43.22	0	0	0	0	131	276.14	409.33		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	426.55	325.76	256.07	128.16	46.22	0	0	0	0	140.1	295.34	437.78		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2055.98	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	167.38	147.73	155.61	140.13	137.79	123.79	119.52	130.27	129.77	145.28	152.81	163.57		
Efficiency of water heater													79.8	(216)
(217)m=	87.05	86.7	85.96	84.4	82.12	79.8	79.8	79.8	79.8	84.54	86.37	87.16		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	192.29	170.39	181.03	166.04	167.79	155.12	149.77	163.25	162.62	171.85	176.92	187.66		
Total = Sum(219a)$_{1...12}$ =													2044.72	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2055.98	
Water heating fuel used			2044.72	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			230.91	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	444.09	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	441.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =			885.75	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	119.84	(268)
Total CO2, kg/year		sum of (265)…(271) =		1044.52	(272)

TER =	21.07	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: 	**Stroma Number:**
Software Name: Stroma FSAP 2012 	**Software Version:** Version: 1.0.4.8

Property Address: b2-12-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.39	(1a) x	2.4	(2a) =	176.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			6.9	x1/[1/(1.2)+ 0.04]		=	7.9			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	40.92	17.94	22.98	x	0.18	=	4.14			(29)
Walls Type2	21.61	2.1	19.51	x	0.18	=	3.51			(29)
Roof	24.37	0	24.37	x	0.11	=	2.68			(30)
Total area of elements, m²			86.9							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	33.39	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		15.93	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	49.32	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.38	78.38	78.38	78.38	78.38	78.38	78.38	78.38	78.38	78.38	78.38	78.38	

Average = Sum(39)$_{1...12}$ /12= 78.38 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07

Average = Sum(40)$_{1...12}$ /12= 1.07 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	98.37	94.8	91.22	87.64	84.07	80.49	80.49	84.07	87.64	91.22	94.8	98.37

Total = Sum(44)$_{1...12}$ = 1073.18 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.89	127.59	131.67	114.79	110.14	95.04	88.07	101.06	102.27	119.19	130.1	141.28

Total = Sum(45)$_{1...12}$ = 1407.11 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.88	19.14	19.75	17.22	16.52	14.26	13.21	15.16	15.34	17.88	19.52	21.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.16	177.52	186.94	168.28	165.42	148.54	143.35	156.34	155.77	174.46	183.6	196.56	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.16	177.52	186.94	168.28	165.42	148.54	143.35	156.34	155.77	174.46	183.6	196.56

Output from water heater (annual)$_{1…12}$ — 2057.94 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.73	82.37	88	80.96	80.84	74.4	73.51	77.83	76.8	83.85	86.05	91.2	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.28	16.24	13.21	10	7.47	6.31	6.82	8.86	11.89	15.1	17.63	18.79	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.08	207.2	201.84	190.43	176.01	162.47	153.42	151.29	156.66	168.07	182.48	196.03	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	(71)

Water heating gains (Table 5)

(72)m=	124.64	122.57	118.28	112.45	108.66	103.33	98.8	104.6	106.67	112.7	119.52	122.58	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	405.88	403.9	391.21	370.75	350.03	329.99	316.92	322.64	333.1	353.76	377.51	395.28	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	6.9	x	19.64	x	0.5	x	0.8	=	37.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	6.9	x	38.42	x	0.5	x	0.8	=	73.49	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	6.9	x	63.27	x	0.5	x	0.8	=	121.02	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	6.9	x	92.28	x	0.5	x	0.8	=	176.5	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	6.9	x	113.09	x	0.5	x	0.8	=	216.31	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)

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West	0.9x	0.77	x	6.9	x	115.77	x	0.5	x	0.8	=	221.43	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	6.9	x	110.22	x	0.5	x	0.8	=	210.81	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	6.9	x	94.68	x	0.5	x	0.8	=	181.08	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	6.9	x	73.59	x	0.5	x	0.8	=	140.75	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	6.9	x	45.59	x	0.5	x	0.8	=	87.2	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	6.9	x	24.49	x	0.5	x	0.8	=	46.84	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	6.9	x	16.15	x	0.5	x	0.8	=	30.89	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	83.89	163.37	270.67	402.57	503.68	520.97	493.73	416.61	316.88	193.97	104.38	69.17	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	489.77	567.26	661.89	773.33	853.72	850.96	810.65	739.25	649.98	547.73	481.9	464.45	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.77	0.57	0.42	0.48	0.76	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.09	20.36	20.69	20.91	20.98	21	20.99	20.94	20.62	20.21	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.89	0.71	0.49	0.33	0.38	0.68	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.61	18.84	19.23	19.67	19.94	20.02	20.03	20.02	19.98	19.6	19.01	18.55	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.14	19.34	19.68	20.08	20.33	20.4	20.41	20.41	20.36	20.01	19.49	19.08	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.14	19.34	19.68	20.08	20.33	20.4	20.41	20.41	20.36	20.01	19.49	19.08	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.96	0.89	0.73	0.53	0.37	0.42	0.71	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	486.94	560.07	638.38	688.04	623.68	447.26	298.08	312.64	458.51	513.73	476.04	462.39	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1163.13	1131.87	1033.26	876.26	676.23	454.9	299	314.55	490.83	737.45	970.9	1166.73	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	503.08	384.25	293.79	135.52	39.1	0	0	0	0	166.45	356.29	524.03	

Total per year (kWh/year) = Sum(98)1...5,9...12 = 2402.51 (98)

Space heating requirement in kWh/m²/year 32.74 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2402.51	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1891.98	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	630.66	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2057.94	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1620.63	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	540.21	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	46.83	(313)

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Cooling System Energy Efficiency Ratio						0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =					0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside						47.49	(330a)
warm air heating system fans						0	(330b)
pump for solar water heating						0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =					47.49	(331)
Energy for lighting (calculated in Appendix L)						322.88	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4978.88	x	0.22		1075.44	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1593.24	x	0.52		-826.89	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4264.82	x	0.22		921.2	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1364.74	x	0.52		-708.3	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	271.94	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	24.31	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	757.7	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					757.7	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	24.65	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	167.57	(379)
Total CO2, kg/year	sum of (376)…(382) =					949.92	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					12.94	(384)
EI rating (section 14)						89.25	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-12-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.39	(1a) x	2.4	(2a) =	176.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 2			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 3			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 4			6.25	x1/[1/(1.4)+ 0.04]		=	8.29			(27)
Windows Type 5			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Walls Type1	40.92	16.25	24.67	x	0.18	=	4.44			(29)
Walls Type2	21.61	2.1	19.51	x	0.18	=	3.51			(29)
Roof	24.37	0	24.37	x	0.13	=	3.17			(30)
Total area of elements, m²			86.9							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 17.12 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 51.88 (37)

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Ventilation heat loss calculated monthly — (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.09	34.86	34.63	33.55	33.35	32.41	32.41	32.24	32.77	33.35	33.76	34.18	(38)

Heat transfer coefficient, W/K — (39)m = (37) + (38)m

(39)m=	86.98	86.74	86.51	85.43	85.23	84.29	84.29	84.12	84.66	85.23	85.64	86.07	

Average = Sum(39)$_{1…12}$ /12= 85.43 (39)

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	1.19	1.18	1.18	1.16	1.16	1.15	1.15	1.15	1.15	1.16	1.17	1.17	

Average = Sum(40)$_{1…12}$ /12= 1.16 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.33 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 89.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	98.37	94.8	91.22	87.64	84.07	80.49	80.49	84.07	87.64	91.22	94.8	98.37	

Total = Sum(44)$_{1…12}$ = 1073.18 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.89	127.59	131.67	114.79	110.14	95.04	88.07	101.06	102.27	119.19	130.1	141.28	

Total = Sum(45)$_{1…12}$ = 1407.11 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.88	19.14	19.75	17.22	16.52	14.26	13.21	15.16	15.34	17.88	19.52	21.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) — 0.75 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	192.48	169.68	178.26	159.88	156.74	140.14	134.67	147.66	147.36	165.78	175.19	187.88	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	192.48	169.68	178.26	159.88	156.74	140.14	134.67	147.66	147.36	165.78	175.19	187.88

Output from water heater (annual)$_{1…12}$ — 1955.72 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.78	76.09	81.05	74.24	73.9	67.68	66.56	70.88	70.08	76.91	79.33	84.25	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.29	16.24	13.21	10	7.47	6.31	6.82	8.86	11.9	15.1	17.63	18.79	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.08	207.2	201.84	190.43	176.01	162.47	153.42	151.29	156.66	168.07	182.48	196.03	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	(71)

Water heating gains (Table 5)

(72)m=	115.3	113.23	108.94	103.11	99.33	93.99	89.46	95.27	97.33	103.37	110.18	113.24	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	399.55	397.56	384.88	364.42	343.7	323.66	310.59	316.31	326.77	347.43	371.18	388.95	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	2.5	x	10.63	x	0.63	x	0.7	=	8.12	(74)
North	0.9x	0.77	x	2.5	x	10.63	x	0.63	x	0.7	=	8.12	(74)
North	0.9x	0.77	x	2.5	x	20.32	x	0.63	x	0.7	=	15.53	(74)
North	0.9x	0.77	x	2.5	x	20.32	x	0.63	x	0.7	=	15.53	(74)
North	0.9x	0.77	x	2.5	x	34.53	x	0.63	x	0.7	=	26.38	(74)
North	0.9x	0.77	x	2.5	x	34.53	x	0.63	x	0.7	=	26.38	(74)
North	0.9x	0.77	x	2.5	x	55.46	x	0.63	x	0.7	=	42.38	(74)
North	0.9x	0.77	x	2.5	x	55.46	x	0.63	x	0.7	=	42.38	(74)
North	0.9x	0.77	x	2.5	x	74.72	x	0.63	x	0.7	=	57.09	(74)
North	0.9x	0.77	x	2.5	x	74.72	x	0.63	x	0.7	=	57.09	(74)
North	0.9x	0.77	x	2.5	x	79.99	x	0.63	x	0.7	=	61.11	(74)
North	0.9x	0.77	x	2.5	x	79.99	x	0.63	x	0.7	=	61.11	(74)
North	0.9x	0.77	x	2.5	x	74.68	x	0.63	x	0.7	=	57.06	(74)
North	0.9x	0.77	x	2.5	x	74.68	x	0.63	x	0.7	=	57.06	(74)
North	0.9x	0.77	x	2.5	x	59.25	x	0.63	x	0.7	=	45.27	(74)
North	0.9x	0.77	x	2.5	x	59.25	x	0.63	x	0.7	=	45.27	(74)
North	0.9x	0.77	x	2.5	x	41.52	x	0.63	x	0.7	=	31.72	(74)
North	0.9x	0.77	x	2.5	x	41.52	x	0.63	x	0.7	=	31.72	(74)
North	0.9x	0.77	x	2.5	x	24.19	x	0.63	x	0.7	=	18.48	(74)
North	0.9x	0.77	x	2.5	x	24.19	x	0.63	x	0.7	=	18.48	(74)
North	0.9x	0.77	x	2.5	x	13.12	x	0.63	x	0.7	=	10.02	(74)
North	0.9x	0.77	x	2.5	x	13.12	x	0.63	x	0.7	=	10.02	(74)
North	0.9x	0.77	x	2.5	x	8.86	x	0.63	x	0.7	=	6.77	(74)
North	0.9x	0.77	x	2.5	x	8.86	x	0.63	x	0.7	=	6.77	(74)
West	0.9x	0.77	x	2.5	x	19.64	x	0.63	x	0.7	=	15.01	(80)
West	0.9x	0.77	x	2.5	x	19.64	x	0.63	x	0.7	=	15.01	(80)
West	0.9x	0.77	x	6.25	x	19.64	x	0.63	x	0.7	=	37.51	(80)
West	0.9x	0.77	x	2.5	x	38.42	x	0.63	x	0.7	=	29.35	(80)
West	0.9x	0.77	x	2.5	x	38.42	x	0.63	x	0.7	=	29.35	(80)
West	0.9x	0.77	x	6.25	x	38.42	x	0.63	x	0.7	=	73.39	(80)
West	0.9x	0.77	x	2.5	x	63.27	x	0.63	x	0.7	=	48.34	(80)
West	0.9x	0.77	x	2.5	x	63.27	x	0.63	x	0.7	=	48.34	(80)
West	0.9x	0.77	x	6.25	x	63.27	x	0.63	x	0.7	=	120.86	(80)
West	0.9x	0.77	x	2.5	x	92.28	x	0.63	x	0.7	=	70.5	(80)
West	0.9x	0.77	x	2.5	x	92.28	x	0.63	x	0.7	=	70.5	(80)
West	0.9x	0.77	x	6.25	x	92.28	x	0.63	x	0.7	=	176.26	(80)
West	0.9x	0.77	x	2.5	x	113.09	x	0.63	x	0.7	=	86.41	(80)
West	0.9x	0.77	x	2.5	x	113.09	x	0.63	x	0.7	=	86.41	(80)
West	0.9x	0.77	x	6.25	x	113.09	x	0.63	x	0.7	=	216.02	(80)
West	0.9x	0.77	x	2.5	x	115.77	x	0.63	x	0.7	=	88.45	(80)
West	0.9x	0.77	x	2.5	x	115.77	x	0.63	x	0.7	=	88.45	(80)

West	0.9x	0.77	x	6.25	x	115.77	x	0.63	x	0.7	=	221.13	(80)
West	0.9x	0.77	x	2.5	x	110.22	x	0.63	x	0.7	=	84.21	(80)
West	0.9x	0.77	x	2.5	x	110.22	x	0.63	x	0.7	=	84.21	(80)
West	0.9x	0.77	x	6.25	x	110.22	x	0.63	x	0.7	=	210.53	(80)
West	0.9x	0.77	x	2.5	x	94.68	x	0.63	x	0.7	=	72.34	(80)
West	0.9x	0.77	x	2.5	x	94.68	x	0.63	x	0.7	=	72.34	(80)
West	0.9x	0.77	x	6.25	x	94.68	x	0.63	x	0.7	=	180.84	(80)
West	0.9x	0.77	x	2.5	x	73.59	x	0.63	x	0.7	=	56.22	(80)
West	0.9x	0.77	x	2.5	x	73.59	x	0.63	x	0.7	=	56.22	(80)
West	0.9x	0.77	x	6.25	x	73.59	x	0.63	x	0.7	=	140.56	(80)
West	0.9x	0.77	x	2.5	x	45.59	x	0.63	x	0.7	=	34.83	(80)
West	0.9x	0.77	x	2.5	x	45.59	x	0.63	x	0.7	=	34.83	(80)
West	0.9x	0.77	x	6.25	x	45.59	x	0.63	x	0.7	=	87.08	(80)
West	0.9x	0.77	x	2.5	x	24.49	x	0.63	x	0.7	=	18.71	(80)
West	0.9x	0.77	x	2.5	x	24.49	x	0.63	x	0.7	=	18.71	(80)
West	0.9x	0.77	x	6.25	x	24.49	x	0.63	x	0.7	=	46.78	(80)
West	0.9x	0.77	x	2.5	x	16.15	x	0.63	x	0.7	=	12.34	(80)
West	0.9x	0.77	x	2.5	x	16.15	x	0.63	x	0.7	=	12.34	(80)
West	0.9x	0.77	x	6.25	x	16.15	x	0.63	x	0.7	=	30.85	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	83.77	163.15	270.31	402.03	503	520.26	493.06	416.04	316.45	193.71	104.24	69.08	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	483.32	560.71	655.18	766.45	846.7	843.92	803.64	732.35	643.22	541.13	475.42	458.02	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.8	0.61	0.46	0.52	0.79	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.77	19.93	20.22	20.59	20.86	20.97	20.99	20.99	20.9	20.53	20.08	19.74	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.93	19.94	19.95	19.95	19.96	19.96	19.96	19.96	19.95	19.95	19.94	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.75	0.52	0.35	0.41	0.71	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.3	18.54	18.96	19.48	19.82	19.94	19.96	19.96	19.88	19.42	18.77	18.27	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.88	19.1	19.46	19.93	20.23	20.36	20.37	20.37	20.29	19.87	19.3	18.86	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(93)m=	18.88	19.1	19.46	19.93	20.23	20.36	20.37	20.37	20.29	19.87	19.3	18.86		(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.99	0.97	0.91	0.76	0.56	0.39	0.45	0.74	0.95	0.99	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	480.68	554.27	635.08	694.21	646.93	471.93	316.28	330.61	475.08	512.27	470.18	456.08		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	1268.48	1231.45	1121.5	941.99	727.43	485.13	318.1	334.12	524.2	789.77	1044.52	1261.33		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	586.12	455.06	361.9	178.4	59.89	0	0	0	0	206.46	413.52	599.11		
												Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2860.46	(98)
Space heating requirement in kWh/m²/year													38.98	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	586.12	455.06	361.9	178.4	59.89	0	0	0	0	206.46	413.52	599.11		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	626.87	486.7	387.05	190.8	64.06	0	0	0	0	220.81	442.27	640.75		
												Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	3059.32	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
												Total (kWh/year) =Sum(215)$_{1...5,10....12}$=	0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)														
	192.48	169.68	178.26	159.88	156.74	140.14	134.67	147.66	147.36	165.78	175.19	187.88		
Efficiency of water heater													79.8	(216)
(217)m=	87.6	87.32	86.67	85.11	82.5	79.8	79.8	79.8	79.8	85.4	87.03	87.69		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	219.74	194.32	205.69	187.86	189.99	175.61	168.76	185.04	184.67	194.12	201.31	214.25		
												Total = Sum(219a)$_{1...12}$ =	2321.35	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3059.32

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Water heating fuel used			2321.35	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			322.93	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	660.81	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	501.41	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1162.22	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	167.6	(268)
Total CO2, kg/year		sum of (265)…(271) =		1368.75	(272)

TER = 18.65 (273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-13-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	52.79	(1a)	x	2.4	(2a)	=	126.7	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.79	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			126.7	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 6			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	37.11	16.56	20.55	x	0.18	=	3.7			(29)
Walls Type2	24.51	2.1	22.41	x	0.18	=	4.03			(29)
Roof	52.79	0	52.79	x	0.11	=	5.81			(30)
Total area of elements, m²			114.41							(31)
Party wall			3.53	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.02 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 17.95 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

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Total fabric heat loss (33) + (36) = 52.98 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.88	73.88	73.88	73.88	73.88	73.88	73.88	73.88	73.88	73.88	73.88	73.88	

Average = Sum(39)$_{1…12}$ /12= 73.88 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	

Average = Sum(40)$_{1…12}$ /12= 1.4 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.77 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 76.29 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	83.92	80.87	77.82	74.77	71.72	68.66	68.66	71.72	74.77	77.82	80.87	83.92	

Total = Sum(44)$_{1…12}$ = 915.53 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	124.46	108.85	112.32	97.93	93.96	81.08	75.13	86.22	87.25	101.68	110.99	120.53	

Total = Sum(45)$_{1…12}$ = 1200.4 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.67	16.33	16.85	14.69	14.09	12.16	11.27	12.93	13.09	15.25	16.65	18.08	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.73	158.78	167.6	151.42	149.24	134.58	130.41	141.5	140.74	156.96	164.48	175.81	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.73	158.78	167.6	151.42	149.24	134.58	130.41	141.5	140.74	156.96	164.48	175.81	

Output from water heater (annual)$_{1...12}$ 1851.24 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.6	76.13	81.57	75.36	75.46	69.75	69.2	72.89	71.8	78.03	79.7	84.3	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.77	12.23	9.95	7.53	5.63	4.75	5.14	6.68	8.96	11.38	13.28	14.15	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	154.47	156.08	152.04	143.44	132.58	122.38	115.56	113.96	118	126.6	137.46	147.66	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	(71)

Water heating gains (Table 5)

(72)m=	115.06	113.3	109.64	104.66	101.43	96.88	93.02	97.97	99.73	104.88	110.69	113.3	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	332.89	331.19	321.21	305.21	289.23	273.6	263.3	268.19	276.28	292.44	311.01	324.7	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)

East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	69.48	134.82	224.48	339.11	431.06	449.3	424.37	353.28	264.19	160.16	86.32	57.42	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	402.37	466.01	545.69	644.32	720.29	722.9	687.67	621.48	540.47	452.6	397.33	382.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.99	0.97	0.92	0.79	0.61	0.46	0.53	0.79	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.58	19.76	20.08	20.48	20.8	20.95	20.99	20.98	20.86	20.43	19.92	19.54	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.76	19.76	19.76	19.76	19.76	19.76	19.76	19.76	19.76	19.76	19.76	19.76	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.89	0.73	0.51	0.34	0.4	0.7	0.93	0.99	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.91	18.17	18.63	19.19	19.59	19.73	19.76	19.76	19.66	19.13	18.41	17.84	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.75	18.97	19.36	19.84	20.19	20.34	20.37	20.37	20.26	19.78	19.16	18.69	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.75	18.97	19.36	19.84	20.19	20.34	20.37	20.37	20.26	19.78	19.16	18.69	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.89	0.75	0.56	0.4	0.46	0.74	0.93	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	398.6	457.78	523.17	573.95	541.53	405.49	275.42	286.97	397.73	422.74	390.45	379.2	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1067.34	1039.21	949.78	808.09	627.51	424.24	278.84	293.18	454.93	678.15	891.36	1070.54	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	497.54	390.72	317.4	168.58	63.97	0	0	0	0	190.03	360.65	514.36	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2503.24 (98)

Space heating requirement in kWh/m²/year 47.42 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)

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Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2503.24	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1971.3	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	657.1	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1851.24	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1457.85	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	485.95	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	45.72	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		34.16	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	34.16	(331)
Energy for lighting (calculated in Appendix L)		243.21	(332)

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12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit							32	(361)
Heat efficiency of CHP unit							38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**			**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	5187.64	x	0.22			1120.53	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1660.04	x	0.52			-861.56	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	3836.45	x	0.22			828.67	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1227.66	x	0.52			-637.16	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel						93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22		=	265.48	(368)
Electrical energy for heat distribution	[(313) x			0.52		=	23.73	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)					=	739.7	(373)
CO2 associated with space heating (secondary)	(309) x			0		=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22		=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =						739.7	(376)

CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	17.73	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	126.23	(379)
Total CO2, kg/year	sum of (376)…(382) =			883.65	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.74	(384)
EI rating (section 14)				87.89	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-13-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	52.79	(1a) x	2.4	(2a) =	126.7	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.79	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	126.7	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.85	x1/[1/(1.4)+ 0.04]		=	2.45			(27)
Windows Type 2			1.85	x1/[1/(1.4)+ 0.04]		=	2.45			(27)
Windows Type 3			1.85	x1/[1/(1.4)+ 0.04]		=	2.45			(27)
Windows Type 4			1.85	x1/[1/(1.4)+ 0.04]		=	2.45			(27)
Windows Type 5			1.85	x1/[1/(1.4)+ 0.04]		=	2.45			(27)
Windows Type 6			1.85	x1/[1/(1.4)+ 0.04]		=	2.45			(27)
Walls Type1	37.11	11.1	26.01	x	0.18	=	4.68			(29)
Walls Type2	24.51	2.1	22.41	x	0.18	=	4.03			(29)
Roof	52.79	0	52.79	x	0.13	=	6.86			(30)
Total area of elements, m²			114.41							(31)
Party wall			3.53	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.39 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 19.13 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

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Total fabric heat loss	(33) + (36) =	51.53	(37)
Ventilation heat loss calculated monthly	(38)m = 0.33 × (25)m x (5)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	24.99	24.83	24.68	23.94	23.81	23.17	23.17	23.05	23.42	23.81	24.08	24.37	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.52	76.36	76.2	75.47	75.34	74.7	74.7	74.58	74.94	75.34	75.61	75.9	

Average = Sum(39)$_{1...12}$ /12= 75.47 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.45	1.45	1.44	1.43	1.43	1.42	1.42	1.41	1.42	1.43	1.43	1.44	

Average = Sum(40)$_{1...12}$ /12= 1.43 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.77 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 76.29 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	83.92	80.87	77.82	74.77	71.72	68.66	68.66	71.72	74.77	77.82	80.87	83.92	

Total = Sum(44)$_{1...12}$ = 915.53 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	124.46	108.85	112.32	97.93	93.96	81.08	75.13	86.22	87.25	101.68	110.99	120.53	

Total = Sum(45)$_{1...12}$ = 1200.4 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.67	16.33	16.85	14.69	14.09	12.16	11.27	12.93	13.09	15.25	16.65	18.08	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		150	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)			
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)			
Water storage loss:			
a) If manufacturer’s declared loss factor is known (kWh/day):		1.39	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0.75	(50)
b) If manufacturer’s declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.75	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	171.05	150.94	158.92	143.02	140.56	126.17	121.73	132.81	132.34	148.27	156.08	167.12	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	171.05	150.94	158.92	143.02	140.56	126.17	121.73	132.81	132.34	148.27	156.08	167.12	

Output from water heater (annual)$_{1\ldots12}$ 1749.02 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	78.66	69.86	74.62	68.63	68.52	63.03	62.26	65.94	65.08	71.08	72.98	77.35	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.81	12.26	9.97	7.55	5.64	4.77	5.15	6.69	8.98	11.41	13.31	14.19	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	154.47	156.08	152.04	143.44	132.58	122.38	115.56	113.96	118	126.6	137.46	147.66	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	(71)

Water heating gains (Table 5)

(72)m=	105.72	103.96	100.3	95.32	92.09	87.55	83.68	88.63	90.39	95.54	101.36	103.97	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	326.59	324.89	314.9	298.9	282.91	267.28	256.98	261.87	269.96	286.14	304.71	318.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.85	x	10.63	x	0.63	x	0.7	=	6.01	(74)
North	0.9x 0.77	x	1.85	x	10.63	x	0.63	x	0.7	=	6.01	(74)
North	0.9x 0.77	x	1.85	x	10.63	x	0.63	x	0.7	=	6.01	(74)
North	0.9x 0.77	x	1.85	x	20.32	x	0.63	x	0.7	=	11.49	(74)
North	0.9x 0.77	x	1.85	x	20.32	x	0.63	x	0.7	=	11.49	(74)
North	0.9x 0.77	x	1.85	x	20.32	x	0.63	x	0.7	=	11.49	(74)
North	0.9x 0.77	x	1.85	x	34.53	x	0.63	x	0.7	=	19.52	(74)
North	0.9x 0.77	x	1.85	x	34.53	x	0.63	x	0.7	=	19.52	(74)
North	0.9x 0.77	x	1.85	x	34.53	x	0.63	x	0.7	=	19.52	(74)
North	0.9x 0.77	x	1.85	x	55.46	x	0.63	x	0.7	=	31.36	(74)
North	0.9x 0.77	x	1.85	x	55.46	x	0.63	x	0.7	=	31.36	(74)
North	0.9x 0.77	x	1.85	x	55.46	x	0.63	x	0.7	=	31.36	(74)
North	0.9x 0.77	x	1.85	x	74.72	x	0.63	x	0.7	=	42.24	(74)
North	0.9x 0.77	x	1.85	x	74.72	x	0.63	x	0.7	=	42.24	(74)
North	0.9x 0.77	x	1.85	x	74.72	x	0.63	x	0.7	=	42.24	(74)
North	0.9x 0.77	x	1.85	x	79.99	x	0.63	x	0.7	=	45.22	(74)
North	0.9x 0.77	x	1.85	x	79.99	x	0.63	x	0.7	=	45.22	(74)
North	0.9x 0.77	x	1.85	x	79.99	x	0.63	x	0.7	=	45.22	(74)
North	0.9x 0.77	x	1.85	x	74.68	x	0.63	x	0.7	=	42.22	(74)
North	0.9x 0.77	x	1.85	x	74.68	x	0.63	x	0.7	=	42.22	(74)
North	0.9x 0.77	x	1.85	x	74.68	x	0.63	x	0.7	=	42.22	(74)
North	0.9x 0.77	x	1.85	x	59.25	x	0.63	x	0.7	=	33.5	(74)
North	0.9x 0.77	x	1.85	x	59.25	x	0.63	x	0.7	=	33.5	(74)
North	0.9x 0.77	x	1.85	x	59.25	x	0.63	x	0.7	=	33.5	(74)
North	0.9x 0.77	x	1.85	x	41.52	x	0.63	x	0.7	=	23.47	(74)
North	0.9x 0.77	x	1.85	x	41.52	x	0.63	x	0.7	=	23.47	(74)
North	0.9x 0.77	x	1.85	x	41.52	x	0.63	x	0.7	=	23.47	(74)
North	0.9x 0.77	x	1.85	x	24.19	x	0.63	x	0.7	=	13.68	(74)
North	0.9x 0.77	x	1.85	x	24.19	x	0.63	x	0.7	=	13.68	(74)
North	0.9x 0.77	x	1.85	x	24.19	x	0.63	x	0.7	=	13.68	(74)
North	0.9x 0.77	x	1.85	x	13.12	x	0.63	x	0.7	=	7.42	(74)
North	0.9x 0.77	x	1.85	x	13.12	x	0.63	x	0.7	=	7.42	(74)
North	0.9x 0.77	x	1.85	x	13.12	x	0.63	x	0.7	=	7.42	(74)
North	0.9x 0.77	x	1.85	x	8.86	x	0.63	x	0.7	=	5.01	(74)
North	0.9x 0.77	x	1.85	x	8.86	x	0.63	x	0.7	=	5.01	(74)
North	0.9x 0.77	x	1.85	x	8.86	x	0.63	x	0.7	=	5.01	(74)
East	0.9x 1	x	1.85	x	19.64	x	0.63	x	0.7	=	11.1	(76)
East	0.9x 1	x	1.85	x	19.64	x	0.63	x	0.7	=	11.1	(76)
East	0.9x 1	x	1.85	x	19.64	x	0.63	x	0.7	=	11.1	(76)

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East	0.9x	1	x	1.85	x	38.42	x	0.63	x	0.7	=	21.72	(76)
East	0.9x	1	x	1.85	x	38.42	x	0.63	x	0.7	=	21.72	(76)
East	0.9x	1	x	1.85	x	38.42	x	0.63	x	0.7	=	21.72	(76)
East	0.9x	1	x	1.85	x	63.27	x	0.63	x	0.7	=	35.77	(76)
East	0.9x	1	x	1.85	x	63.27	x	0.63	x	0.7	=	35.77	(76)
East	0.9x	1	x	1.85	x	63.27	x	0.63	x	0.7	=	35.77	(76)
East	0.9x	1	x	1.85	x	92.28	x	0.63	x	0.7	=	52.17	(76)
East	0.9x	1	x	1.85	x	92.28	x	0.63	x	0.7	=	52.17	(76)
East	0.9x	1	x	1.85	x	92.28	x	0.63	x	0.7	=	52.17	(76)
East	0.9x	1	x	1.85	x	113.09	x	0.63	x	0.7	=	63.94	(76)
East	0.9x	1	x	1.85	x	113.09	x	0.63	x	0.7	=	63.94	(76)
East	0.9x	1	x	1.85	x	113.09	x	0.63	x	0.7	=	63.94	(76)
East	0.9x	1	x	1.85	x	115.77	x	0.63	x	0.7	=	65.45	(76)
East	0.9x	1	x	1.85	x	115.77	x	0.63	x	0.7	=	65.45	(76)
East	0.9x	1	x	1.85	x	115.77	x	0.63	x	0.7	=	65.45	(76)
East	0.9x	1	x	1.85	x	110.22	x	0.63	x	0.7	=	62.32	(76)
East	0.9x	1	x	1.85	x	110.22	x	0.63	x	0.7	=	62.32	(76)
East	0.9x	1	x	1.85	x	110.22	x	0.63	x	0.7	=	62.32	(76)
East	0.9x	1	x	1.85	x	94.68	x	0.63	x	0.7	=	53.53	(76)
East	0.9x	1	x	1.85	x	94.68	x	0.63	x	0.7	=	53.53	(76)
East	0.9x	1	x	1.85	x	94.68	x	0.63	x	0.7	=	53.53	(76)
East	0.9x	1	x	1.85	x	73.59	x	0.63	x	0.7	=	41.61	(76)
East	0.9x	1	x	1.85	x	73.59	x	0.63	x	0.7	=	41.61	(76)
East	0.9x	1	x	1.85	x	73.59	x	0.63	x	0.7	=	41.61	(76)
East	0.9x	1	x	1.85	x	45.59	x	0.63	x	0.7	=	25.78	(76)
East	0.9x	1	x	1.85	x	45.59	x	0.63	x	0.7	=	25.78	(76)
East	0.9x	1	x	1.85	x	45.59	x	0.63	x	0.7	=	25.78	(76)
East	0.9x	1	x	1.85	x	24.49	x	0.63	x	0.7	=	13.85	(76)
East	0.9x	1	x	1.85	x	24.49	x	0.63	x	0.7	=	13.85	(76)
East	0.9x	1	x	1.85	x	24.49	x	0.63	x	0.7	=	13.85	(76)
East	0.9x	1	x	1.85	x	16.15	x	0.63	x	0.7	=	9.13	(76)
East	0.9x	1	x	1.85	x	16.15	x	0.63	x	0.7	=	9.13	(76)
East	0.9x	1	x	1.85	x	16.15	x	0.63	x	0.7	=	9.13	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	51.35	99.63	165.89	250.6	318.55	332.03	313.61	261.08	195.24	118.36	63.79	42.43	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	377.94	424.52	480.79	549.5	601.46	599.31	570.59	522.95	465.2	404.49	368.5	360.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	1	0.99	0.98	0.95	0.87	0.71	0.55	0.61	0.85	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.48	19.64	19.93	20.34	20.7	20.91	20.98	20.96	20.79	20.34	19.84	19.45	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.73	19.73	19.73	19.74	19.74	19.75	19.75	19.75	19.75	19.74	19.74	19.73	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.98	0.93	0.81	0.6	0.41	0.47	0.77	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.74	17.97	18.4	18.98	19.45	19.69	19.74	19.74	19.59	18.99	18.27	17.7	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.61	18.8	19.16	19.66	20.07	20.3	20.36	20.35	20.19	19.66	19.06	18.58	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.61	18.8	19.16	19.66	20.07	20.3	20.36	20.35	20.19	19.66	19.06	18.58	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.93	0.83	0.65	0.48	0.54	0.8	0.95	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	375.07	419.05	467.57	510.51	498.06	391.64	273.81	283.06	373.15	385.4	363.56	358.56	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1094.84	1061.53	965.09	812.01	630.82	425.98	280.89	294.7	456.43	682.88	904.1	1091.34	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	535.51	431.74	370.15	217.08	98.77	0	0	0	0	221.33	389.19	545.19	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2808.96 (98)

Space heating requirement in kWh/m²/year 53.21 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	535.51	431.74	370.15	217.08	98.77	0	0	0	0	221.33	389.19	545.19	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	572.74	461.76	395.89	232.17	105.64	0	0	0	0	236.71	416.24	583.09	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3004.24 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

171.05	150.94	158.92	143.02	140.56	126.17	121.73	132.81	132.34	148.27	156.08	167.12

Efficiency of water heater 79.8 (216)

(217)m=	87.65	87.46	87	85.92	83.89	79.8	79.8	79.8	79.8	85.88	87.15	87.74	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.14	172.57	182.67	166.45	167.54	158.11	152.54	166.43	165.84	172.65	179.09	190.48

Total = Sum(219a)$_{1...12}$ = 2069.52 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3004.24	
Water heating fuel used		2069.52	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		243.85	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	648.91	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	447.02	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1095.93	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	126.56	(268)
Total CO2, kg/year			sum of (265)…(271) =		1261.42	(272)

TER = 23.89 (273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-13-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	54.69	(1a) x	2.4	(2a) =	131.26	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54.69	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	131.26	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) = 0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			6.93	x1/[1/(1.2)+ 0.04]		=	7.94			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	39.6	16.13	23.47	x	0.18	=	4.22			(29)
Walls Type2	33.71	2.1	31.61	x	0.18	=	5.69			(29)
Roof	54.69	0	54.69	x	0.11	=	6.02			(30)
Total area of elements, m²			128							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 36.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.25 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 51.17 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	72.83	72.83	72.83	72.83	72.83	72.83	72.83	72.83	72.83	72.83	72.83	72.83	

Average = Sum(39)$_{1...12}$ /12= 72.83 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	

Average = Sum(40)$_{1...12}$ /12= 1.33 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.83 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.62 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	85.38	82.28	79.17	76.07	72.96	69.86	69.86	72.96	76.07	79.17	82.28	85.38	

Total = Sum(44)$_{1...12}$ = 931.46 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	126.62	110.74	114.28	99.63	95.6	82.49	76.44	87.72	88.77	103.45	112.92	122.63	

Total = Sum(45)$_{1...12}$ = 1221.29 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.99	16.61	17.14	14.94	14.34	12.37	11.47	13.16	13.31	15.52	16.94	18.39	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.9	160.67	169.55	153.12	150.87	135.99	131.72	143	142.26	158.73	166.42	177.9	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.9	160.67	169.55	153.12	150.87	135.99	131.72	143	142.26	158.73	166.42	177.9

Output from water heater (annual)$_{1\ldots12}$ | 1872.13 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.32	76.76	82.22	75.92	76.01	70.22	69.64	73.39	72.31	78.62	80.34	84.99	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.21	12.62	10.26	7.77	5.81	4.9	5.3	6.89	9.24	11.74	13.7	14.6	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	159.39	161.04	156.87	148	136.8	126.27	119.24	117.59	121.75	130.63	141.83	152.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	(71)

Water heating gains (Table 5)

(72)m=	116.03	114.23	110.51	105.45	102.16	97.53	93.6	98.64	100.43	105.67	111.59	114.24	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.05	338.32	328.07	311.64	295.19	279.13	268.56	273.54	281.85	298.46	317.54	331.62	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(76)
East	0.9x	1	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(76)

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East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(76)
East	0.9x	1	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(76)
East	0.9x	1	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(76)
East	0.9x	1	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(76)
East	0.9x	1	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(76)
East	0.9x	1	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(76)
East	0.9x	1	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(76)
East	0.9x	1	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(76)
East	0.9x	1	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(76)
East	0.9x	1	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(76)
East	0.9x	1	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)

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East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(76)
East	0.9x	1	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	6.93	x	46.75	x	0.5	x	0.8	=	89.81	(78)
South	0.9x	0.77	x	6.93	x	76.57	x	0.5	x	0.8	=	147.09	(78)
South	0.9x	0.77	x	6.93	x	97.53	x	0.5	x	0.8	=	187.36	(78)
South	0.9x	0.77	x	6.93	x	110.23	x	0.5	x	0.8	=	211.76	(78)
South	0.9x	0.77	x	6.93	x	114.87	x	0.5	x	0.8	=	220.67	(78)
South	0.9x	0.77	x	6.93	x	110.55	x	0.5	x	0.8	=	212.36	(78)
South	0.9x	0.77	x	6.93	x	108.01	x	0.5	x	0.8	=	207.49	(78)
South	0.9x	0.77	x	6.93	x	104.89	x	0.5	x	0.8	=	201.5	(78)
South	0.9x	0.77	x	6.93	x	101.89	x	0.5	x	0.8	=	195.72	(78)
South	0.9x	0.77	x	6.93	x	82.59	x	0.5	x	0.8	=	158.65	(78)
South	0.9x	0.77	x	6.93	x	55.42	x	0.5	x	0.8	=	106.46	(78)
South	0.9x	0.77	x	6.93	x	40.4	x	0.5	x	0.8	=	77.6	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	139.9	245.07	348.72	447.1	509.08	507.6	488.57	442.95	383.39	274.91	168.91	118.79	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	479.94	583.39	676.79	758.74	804.27	786.74	757.14	716.49	665.24	573.37	486.45	450.42	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.87	0.74	0.57	0.42	0.46	0.69	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.77	20	20.31	20.64	20.86	20.97	20.99	20.99	20.93	20.61	20.11	19.71	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.82	19.82	19.82	19.82	19.82	19.82	19.82	19.82	19.82	19.82	19.82	19.82	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.84	0.67	0.47	0.31	0.35	0.59	0.88	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.22	18.55	18.99	19.42	19.7	19.8	19.81	19.81	19.77	19.4	18.71	18.13	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.99	19.27	19.65	20.03	20.28	20.38	20.4	20.4	20.35	20.01	19.41	18.92	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.99	19.27	19.65	20.03	20.28	20.38	20.4	20.4	20.35	20.01	19.41	18.92	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.98	0.97	0.93	0.84	0.7	0.52	0.36	0.4	0.64	0.88	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	472.54	563.73	627.44	639.88	564.81	408.8	275.06	288.3	424.9	505.69	471.52	444.99	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1070.09	1046.82	957.54	810.59	624.97	421.13	277.02	291.41	454.86	685.04	896.61	1072.11	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	444.57	324.64	245.59	122.91	44.76	0	0	0	0	133.44	306.07	466.58

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2088.55 (98)

Space heating requirement in kWh/m²/year 38.19 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2088.55	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1644.73	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	548.24	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		1872.13	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1474.3	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	491.43	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	41.59	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		35.39	(330a)

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warm air heating system fans					0	(330b)
pump for solar water heating					0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =				35.39	(331)
Energy for lighting (calculated in Appendix L)					250.94	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit					32	(361)
Heat efficiency of CHP unit					38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**	**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4328.24	x	0.22	934.9	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1385.04	x	0.52	-718.83	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	3879.74	x	0.22	838.02	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1241.52	x	0.52	-644.35	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22 =	241.47	(368)
Electrical energy for heat distribution	[(313) x			0.52 =	21.58	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	672.8	(373)
CO2 associated with space heating (secondary)	(309) x			0 =	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22 =	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				672.8	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52 =	18.37	(378)
CO2 associated with electricity for lighting	(332))) x			0.52 =	130.24	(379)
Total CO2, kg/year	sum of (376)…(382) =				821.41	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				15.02	(384)
EI rating (section 14)					88.96	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-13-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	54.69	(1a)	x	2.4	(2a)	=	131.26	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54.69	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			131.26	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.32	0.32	0.32	0.34	0.37	0.38	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.32	x1/[1/(1.4)+ 0.04]		=	1.75			(27)
Windows Type 2			1.32	x1/[1/(1.4)+ 0.04]		=	1.75			(27)
Windows Type 3			4.97	x1/[1/(1.4)+ 0.04]		=	6.59			(27)
Windows Type 4			1.98	x1/[1/(1.4)+ 0.04]		=	2.62			(27)
Windows Type 5			1.98	x1/[1/(1.4)+ 0.04]		=	2.62			(27)
Walls Type1	39.6	11.57	28.03	x	0.18	=	5.05			(29)
Walls Type2	33.71	2.1	31.61	x	0.18	=	5.69			(29)
Roof	54.69	0	54.69	x	0.13	=	7.11			(30)
Total area of elements, m²			128							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 17.42 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 52.7 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	25.78	25.62	25.46	24.72	24.58	23.94	23.94	23.82	24.19	24.58	24.86	25.15	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.48	78.32	78.16	77.43	77.29	76.65	76.65	76.53	76.9	77.29	77.57	77.86	

Average = Sum(39)1…12 /12= 77.43 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.44	1.43	1.43	1.42	1.41	1.4	1.4	1.4	1.41	1.41	1.42	1.42

Average = Sum(40)1…12 /12= 1.42 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.83 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 77.62 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	85.38	82.28	79.17	76.07	72.96	69.86	69.86	72.96	76.07	79.17	82.28	85.38

Total = Sum(44)1…12 = 931.46 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	126.62	110.74	114.28	99.63	95.6	82.49	76.44	87.72	88.77	103.45	112.92	122.63

Total = Sum(45)1…12 = 1221.29 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.99	16.61	17.14	14.94	14.34	12.37	11.47	13.16	13.31	15.52	16.94	18.39	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	173.22	152.83	160.87	144.72	142.19	127.59	123.04	134.31	133.86	150.04	158.01	169.22	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	173.22	152.83	160.87	144.72	142.19	127.59	123.04	134.31	133.86	150.04	158.01	169.22

Output from water heater (annual) 1…12	1769.9	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	79.38	70.49	75.27	69.2	69.06	63.5	62.69	66.44	65.59	71.67	73.62	78.05	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.24	12.65	10.29	7.79	5.82	4.91	5.31	6.9	9.26	11.76	13.73	14.64	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	159.39	161.04	156.87	148	136.8	126.27	119.24	117.59	121.75	130.63	141.83	152.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	(71)

Water heating gains (Table 5)

(72)m=	106.69	104.9	101.17	96.11	92.83	88.2	84.26	89.3	91.09	96.33	102.25	104.9	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	333.74	332.01	321.76	305.32	288.87	272.81	262.24	267.22	275.54	292.15	311.23	325.32	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	1.32	x	19.64	x	0.63	x	0.7	=	7.92	(76)
East	0.9x	1	x	1.32	x	19.64	x	0.63	x	0.7	=	7.92	(76)

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East	0.9x	1	x	1.98	x	19.64	x	0.63	x	0.7	=	11.88	(76)
East	0.9x	1	x	1.98	x	19.64	x	0.63	x	0.7	=	11.88	(76)
East	0.9x	1	x	1.32	x	38.42	x	0.63	x	0.7	=	15.5	(76)
East	0.9x	1	x	1.32	x	38.42	x	0.63	x	0.7	=	15.5	(76)
East	0.9x	1	x	1.98	x	38.42	x	0.63	x	0.7	=	23.25	(76)
East	0.9x	1	x	1.98	x	38.42	x	0.63	x	0.7	=	23.25	(76)
East	0.9x	1	x	1.32	x	63.27	x	0.63	x	0.7	=	25.52	(76)
East	0.9x	1	x	1.32	x	63.27	x	0.63	x	0.7	=	25.52	(76)
East	0.9x	1	x	1.98	x	63.27	x	0.63	x	0.7	=	38.29	(76)
East	0.9x	1	x	1.98	x	63.27	x	0.63	x	0.7	=	38.29	(76)
East	0.9x	1	x	1.32	x	92.28	x	0.63	x	0.7	=	37.23	(76)
East	0.9x	1	x	1.32	x	92.28	x	0.63	x	0.7	=	37.23	(76)
East	0.9x	1	x	1.98	x	92.28	x	0.63	x	0.7	=	55.84	(76)
East	0.9x	1	x	1.98	x	92.28	x	0.63	x	0.7	=	55.84	(76)
East	0.9x	1	x	1.32	x	113.09	x	0.63	x	0.7	=	45.62	(76)
East	0.9x	1	x	1.32	x	113.09	x	0.63	x	0.7	=	45.62	(76)
East	0.9x	1	x	1.98	x	113.09	x	0.63	x	0.7	=	68.43	(76)
East	0.9x	1	x	1.98	x	113.09	x	0.63	x	0.7	=	68.43	(76)
East	0.9x	1	x	1.32	x	115.77	x	0.63	x	0.7	=	46.7	(76)
East	0.9x	1	x	1.32	x	115.77	x	0.63	x	0.7	=	46.7	(76)
East	0.9x	1	x	1.98	x	115.77	x	0.63	x	0.7	=	70.05	(76)
East	0.9x	1	x	1.98	x	115.77	x	0.63	x	0.7	=	70.05	(76)
East	0.9x	1	x	1.32	x	110.22	x	0.63	x	0.7	=	44.46	(76)
East	0.9x	1	x	1.32	x	110.22	x	0.63	x	0.7	=	44.46	(76)
East	0.9x	1	x	1.98	x	110.22	x	0.63	x	0.7	=	66.69	(76)
East	0.9x	1	x	1.98	x	110.22	x	0.63	x	0.7	=	66.69	(76)
East	0.9x	1	x	1.32	x	94.68	x	0.63	x	0.7	=	38.19	(76)
East	0.9x	1	x	1.32	x	94.68	x	0.63	x	0.7	=	38.19	(76)
East	0.9x	1	x	1.98	x	94.68	x	0.63	x	0.7	=	57.29	(76)
East	0.9x	1	x	1.98	x	94.68	x	0.63	x	0.7	=	57.29	(76)
East	0.9x	1	x	1.32	x	73.59	x	0.63	x	0.7	=	29.69	(76)
East	0.9x	1	x	1.32	x	73.59	x	0.63	x	0.7	=	29.69	(76)
East	0.9x	1	x	1.98	x	73.59	x	0.63	x	0.7	=	44.53	(76)
East	0.9x	1	x	1.98	x	73.59	x	0.63	x	0.7	=	44.53	(76)
East	0.9x	1	x	1.32	x	45.59	x	0.63	x	0.7	=	18.39	(76)
East	0.9x	1	x	1.32	x	45.59	x	0.63	x	0.7	=	18.39	(76)
East	0.9x	1	x	1.98	x	45.59	x	0.63	x	0.7	=	27.59	(76)
East	0.9x	1	x	1.98	x	45.59	x	0.63	x	0.7	=	27.59	(76)
East	0.9x	1	x	1.32	x	24.49	x	0.63	x	0.7	=	9.88	(76)
East	0.9x	1	x	1.32	x	24.49	x	0.63	x	0.7	=	9.88	(76)
East	0.9x	1	x	1.98	x	24.49	x	0.63	x	0.7	=	14.82	(76)

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East	0.9x	1	x	1.98	x	24.49	x	0.63	x	0.7	=	14.82	(76)
East	0.9x	1	x	1.32	x	16.15	x	0.63	x	0.7	=	6.52	(76)
East	0.9x	1	x	1.32	x	16.15	x	0.63	x	0.7	=	6.52	(76)
East	0.9x	1	x	1.98	x	16.15	x	0.63	x	0.7	=	9.77	(76)
East	0.9x	1	x	1.98	x	16.15	x	0.63	x	0.7	=	9.77	(76)
South	0.9x	0.77	x	4.97	x	46.75	x	0.63	x	0.7	=	71.01	(78)
South	0.9x	0.77	x	4.97	x	76.57	x	0.63	x	0.7	=	116.3	(78)
South	0.9x	0.77	x	4.97	x	97.53	x	0.63	x	0.7	=	148.14	(78)
South	0.9x	0.77	x	4.97	x	110.23	x	0.63	x	0.7	=	167.43	(78)
South	0.9x	0.77	x	4.97	x	114.87	x	0.63	x	0.7	=	174.48	(78)
South	0.9x	0.77	x	4.97	x	110.55	x	0.63	x	0.7	=	167.91	(78)
South	0.9x	0.77	x	4.97	x	108.01	x	0.63	x	0.7	=	164.06	(78)
South	0.9x	0.77	x	4.97	x	104.89	x	0.63	x	0.7	=	159.32	(78)
South	0.9x	0.77	x	4.97	x	101.89	x	0.63	x	0.7	=	154.75	(78)
South	0.9x	0.77	x	4.97	x	82.59	x	0.63	x	0.7	=	125.44	(78)
South	0.9x	0.77	x	4.97	x	55.42	x	0.63	x	0.7	=	84.17	(78)
South	0.9x	0.77	x	4.97	x	40.4	x	0.63	x	0.7	=	61.36	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	110.63	193.79	275.77	353.57	402.59	401.43	386.37	350.29	303.19	217.39	133.57	93.94	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	444.37	525.81	597.53	658.89	691.46	674.23	648.61	617.51	578.72	509.54	444.8	419.26	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.92	0.83	0.67	0.5	0.55	0.77	0.94	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.58	19.79	20.09	20.46	20.76	20.93	20.98	20.98	20.86	20.47	19.95	19.54	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.74	19.74	19.74	19.75	19.75	19.76	19.76	19.76	19.76	19.75	19.75	19.75	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.89	0.77	0.56	0.37	0.41	0.68	0.92	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.89	18.19	18.63	19.15	19.53	19.72	19.76	19.76	19.66	19.18	18.44	17.84	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.74	18.99	19.36	19.8	20.14	20.33	20.37	20.37	20.26	19.82	19.2	18.69	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.74	18.99	19.36	19.8	20.14	20.33	20.37	20.37	20.26	19.82	19.2	18.69	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.9	0.79	0.61	0.44	0.48	0.72	0.92	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	439.16	513.61	568.95	590.07	543.72	411.97	283.98	296.12	418.13	467.88	434.91	415.32	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1133.02	1103.5	1005.36	844.33	652.63	438.88	288.99	303.53	473.89	712.85	938.43	1128.4	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	516.23	396.41	324.69	183.06	81.03	0	0	0	0	182.26	362.53	530.53

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2576.75 (98)

Space heating requirement in kWh/m²/year 47.12 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	516.23	396.41	324.69	183.06	81.03	0	0	0	0	182.26	362.53	530.53	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	552.12	423.96	347.26	195.79	86.67	0	0	0	0	194.93	387.74	567.41	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2755.88 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

173.22	152.83	160.87	144.72	142.19	127.59	123.04	134.31	133.86	150.04	158.01	169.22

Efficiency of water heater 79.8 (216)

(217)m=	87.55	87.24	86.65	85.44	83.38	79.8	79.8	79.8	79.8	85.33	86.96	87.66	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	197.85	175.17	185.66	169.38	170.54	159.88	154.18	168.31	167.74	175.83	181.71	193.05

Total = Sum(219a)$_{1...12}$ = 2099.3 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2755.88
Water heating fuel used		2099.3
Electricity for pumps, fans and electric keep-hot		

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central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			251.51	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	595.27	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	453.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1048.72	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	130.53	(268)
Total CO2, kg/year			sum of (265)…(271) =		1218.18	(272)

TER = 22.27 (273)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b2-13-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	52.6	(1a) x	2.4	(2a) =	126.24	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.6	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	126.24	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			6.99	x1/[1/(1.2)+ 0.04]		=	8			(27)
Walls Type1	35.49	15.27	20.22	x	0.18	=	3.64			(29)
Walls Type2	26.7	2.1	24.6	x	0.18	=	4.43			(29)
Roof	52.6	0	52.6	x	0.11	=	5.79			(30)
Total area of elements, m²			114.79							(31)
Party wall			15.58	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.86 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.48 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 46.34 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	20.83	20.83	20.83	20.83	20.83	20.83	20.83	20.83	20.83	20.83	20.83	20.83	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	67.17	67.17	67.17	67.17	67.17	67.17	67.17	67.17	67.17	67.17	67.17	67.17	

Average = $Sum(39)_{1...12}$ /12= 67.17 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	

Average = $Sum(40)_{1...12}$ /12= 1.28 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.77 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 76.16 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	83.78	80.73	77.68	74.64	71.59	68.54	68.54	71.59	74.64	77.68	80.73	83.78	

Total = $Sum(44)_{1...12}$ = 913.93 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	124.24	108.66	112.13	97.76	93.8	80.94	75	86.07	87.1	101.5	110.8	120.32	

Total = $Sum(45)_{1...12}$ = 1198.31 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.64	16.3	16.82	14.66	14.07	12.14	11.25	12.91	13.06	15.23	16.62	18.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.52	158.59	167.4	151.25	149.08	134.43	130.28	141.34	140.59	156.78	164.29	175.6	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.52	158.59	167.4	151.25	149.08	134.43	130.28	141.34	140.59	156.78	164.29	175.6	

Output from water heater (annual)1…12 | 1849.15 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.53	76.07	81.5	75.3	75.41	69.71	69.16	72.84	71.75	77.97	79.63	84.23	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.73	12.19	9.92	7.51	5.61	4.74	5.12	6.65	8.93	11.34	13.24	14.11	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	153.98	155.58	151.55	142.98	132.16	121.99	115.2	113.6	117.63	126.2	137.02	147.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	(71)

Water heating gains (Table 5)

(72)m=	114.96	113.2	109.55	104.58	101.36	96.82	92.96	97.9	99.66	104.8	110.6	113.21	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	332.17	330.48	320.52	304.57	288.63	273.05	262.77	267.66	275.72	291.84	310.36	324.01	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	6.99	x	46.75	x	0.5	x	0.8	=	90.59	(78)
South	0.9x	0.77	x	6.99	x	76.57	x	0.5	x	0.8	=	148.36	(78)

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South	0.9x	0.77	x	6.99	x	97.53	x	0.5	x	0.8	=	188.98	(78)
South	0.9x	0.77	x	6.99	x	110.23	x	0.5	x	0.8	=	213.59	(78)
South	0.9x	0.77	x	6.99	x	114.87	x	0.5	x	0.8	=	222.58	(78)
South	0.9x	0.77	x	6.99	x	110.55	x	0.5	x	0.8	=	214.2	(78)
South	0.9x	0.77	x	6.99	x	108.01	x	0.5	x	0.8	=	209.29	(78)
South	0.9x	0.77	x	6.99	x	104.89	x	0.5	x	0.8	=	203.25	(78)
South	0.9x	0.77	x	6.99	x	101.89	x	0.5	x	0.8	=	197.42	(78)
South	0.9x	0.77	x	6.99	x	82.59	x	0.5	x	0.8	=	160.02	(78)
South	0.9x	0.77	x	6.99	x	55.42	x	0.5	x	0.8	=	107.38	(78)
South	0.9x	0.77	x	6.99	x	40.4	x	0.5	x	0.8	=	78.28	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)

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West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	135.67	236.54	334.21	425.4	482.15	479.92	462.26	420.55	366.32	264.66	163.59	115.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	467.84	567.02	654.73	729.97	770.78	752.96	725.04	688.2	642.04	556.49	473.94	439.35	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.86	0.73	0.55	0.4	0.44	0.67	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.85	20.08	20.38	20.68	20.89	20.97	21	20.99	20.94	20.66	20.18	19.79	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.86	19.86	19.86	19.86	19.86	19.86	19.86	19.86	19.86	19.86	19.86	19.86	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.83	0.66	0.46	0.3	0.34	0.58	0.86	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.37	18.69	19.11	19.52	19.76	19.84	19.86	19.86	19.82	19.5	18.84	18.28	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.11	19.39	19.74	20.1	20.32	20.41	20.43	20.42	20.38	20.08	19.51	19.04	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.11	19.39	19.74	20.1	20.32	20.41	20.43	20.42	20.38	20.08	19.51	19.04	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.92	0.83	0.69	0.51	0.35	0.39	0.62	0.87	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	460.16	546.57	603.77	609.07	531.23	381	255.63	268.13	398.92	485.66	458.29	433.74	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	994.68	972.97	889.58	752.26	579.26	390.21	257	270.31	421.8	636.61	833.66	996.55	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	397.68	286.54	212.64	103.1	35.73	0	0	0	0	112.3	270.27	418.73	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1837 | (98)

Space heating requirement in kWh/m²/year | 34.92 | (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1837	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1446.63	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	482.21	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1849.15	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1456.2	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	485.4	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	38.7	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		34.04	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	34.04	(331)
Energy for lighting (calculated in Appendix L)		242.43	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	3806.93	x	0.22	822.3	(363)

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DER WorkSheet: New dwelling design stage

less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1218.22	x	0.52		-632.26	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	3832.11	x	0.22		827.74	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1226.28	x	0.52		-636.44	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	224.74	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	20.09	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	626.16	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					626.16	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	17.67	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	125.82	(379)
Total CO2, kg/year	sum of (376)…(382) =					769.65	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					14.63	(384)
EI rating (section 14)						89.43	(385)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version: Version: 1.0.4.8

Property Address: b2-13-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	52.6	(1a) x	2.4	(2a) =	126.24	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.6	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	126.24	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20 ÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.43	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2	x1/[1/(1.4)+ 0.04]		=	2.65			(27)
Windows Type 2			2	x1/[1/(1.4)+ 0.04]		=	2.65			(27)
Windows Type 3			2	x1/[1/(1.4)+ 0.04]		=	2.65			(27)
Windows Type 4			5.06	x1/[1/(1.4)+ 0.04]		=	6.71			(27)
Walls Type1	35.49	11.06	24.43	x	0.18	=	4.4			(29)
Walls Type2	26.7	2.1	24.6	x	0.18	=	4.43			(29)
Roof	52.6	0	52.6	x	0.13	=	6.84			(30)
Total area of elements, m²			114.79							(31)
Party wall			15.58	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.43 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.01 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 47.44 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	24.91	24.75	24.6	23.87	23.73	23.1	23.1	22.98	23.34	23.73	24.01	24.3	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	72.35	72.19	72.03	71.3	71.17	70.53	70.53	70.41	70.78	71.17	71.44	71.73

Average = Sum(39)$_{1…12}$ /12= 71.3 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.38	1.37	1.37	1.36	1.35	1.34	1.34	1.34	1.35	1.35	1.36	1.36

Average = Sum(40)$_{1…12}$ /12= 1.36 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.77 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 76.16 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	83.78	80.73	77.68	74.64	71.59	68.54	68.54	71.59	74.64	77.68	80.73	83.78

Total = Sum(44)$_{1…12}$ = 913.93 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	124.24	108.66	112.13	97.76	93.8	80.94	75	86.07	87.1	101.5	110.8	120.32

Total = Sum(45)$_{1…12}$ = 1198.31 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.64	16.3	16.82	14.66	14.07	12.14	11.25	12.91	13.06	15.23	16.62	18.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	170.83	150.75	158.72	142.85	140.39	126.03	121.6	132.66	132.19	148.1	155.89	166.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	170.83	150.75	158.72	142.85	140.39	126.03	121.6	132.66	132.19	148.1	155.89	166.91

Output from water heater (annual)$_{1...12}$ | 1746.92 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	78.59	69.8	74.56	68.58	68.46	62.99	62.21	65.89	65.03	71.03	72.91	77.28	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.76	12.23	9.94	7.53	5.63	4.75	5.13	6.67	8.95	11.37	13.27	14.15	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	153.98	155.58	151.55	142.98	132.16	121.99	115.2	113.6	117.63	126.2	137.02	147.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	(71)

Water heating gains (Table 5)

(72)m=	105.63	103.87	100.21	95.25	92.02	87.48	83.62	88.57	90.32	95.46	101.27	103.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	325.87	324.17	314.21	298.26	282.31	266.72	256.45	261.34	269.4	285.53	304.06	317.71	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	5.06	x	46.75	x	0.63	x	0.7	=	72.3	(78)
South	0.9x	0.77	x	5.06	x	76.57	x	0.63	x	0.7	=	118.4	(78)

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South	0.9x	0.77	x	5.06	x	97.53	x	0.63	x	0.7	=	150.83	(78)
South	0.9x	0.77	x	5.06	x	110.23	x	0.63	x	0.7	=	170.47	(78)
South	0.9x	0.77	x	5.06	x	114.87	x	0.63	x	0.7	=	177.64	(78)
South	0.9x	0.77	x	5.06	x	110.55	x	0.63	x	0.7	=	170.95	(78)
South	0.9x	0.77	x	5.06	x	108.01	x	0.63	x	0.7	=	167.03	(78)
South	0.9x	0.77	x	5.06	x	104.89	x	0.63	x	0.7	=	162.21	(78)
South	0.9x	0.77	x	5.06	x	101.89	x	0.63	x	0.7	=	157.56	(78)
South	0.9x	0.77	x	5.06	x	82.59	x	0.63	x	0.7	=	127.71	(78)
South	0.9x	0.77	x	5.06	x	55.42	x	0.63	x	0.7	=	85.7	(78)
South	0.9x	0.77	x	5.06	x	40.4	x	0.63	x	0.7	=	62.47	(78)
West	0.9x	0.77	x	2	x	19.64	x	0.63	x	0.7	=	12	(80)
West	0.9x	0.77	x	2	x	19.64	x	0.63	x	0.7	=	12	(80)
West	0.9x	0.77	x	2	x	19.64	x	0.63	x	0.7	=	12	(80)
West	0.9x	0.77	x	2	x	38.42	x	0.63	x	0.7	=	23.48	(80)
West	0.9x	0.77	x	2	x	38.42	x	0.63	x	0.7	=	23.48	(80)
West	0.9x	0.77	x	2	x	38.42	x	0.63	x	0.7	=	23.48	(80)
West	0.9x	0.77	x	2	x	63.27	x	0.63	x	0.7	=	38.67	(80)
West	0.9x	0.77	x	2	x	63.27	x	0.63	x	0.7	=	38.67	(80)
West	0.9x	0.77	x	2	x	63.27	x	0.63	x	0.7	=	38.67	(80)
West	0.9x	0.77	x	2	x	92.28	x	0.63	x	0.7	=	56.4	(80)
West	0.9x	0.77	x	2	x	92.28	x	0.63	x	0.7	=	56.4	(80)
West	0.9x	0.77	x	2	x	92.28	x	0.63	x	0.7	=	56.4	(80)
West	0.9x	0.77	x	2	x	113.09	x	0.63	x	0.7	=	69.13	(80)
West	0.9x	0.77	x	2	x	113.09	x	0.63	x	0.7	=	69.13	(80)
West	0.9x	0.77	x	2	x	113.09	x	0.63	x	0.7	=	69.13	(80)
West	0.9x	0.77	x	2	x	115.77	x	0.63	x	0.7	=	70.76	(80)
West	0.9x	0.77	x	2	x	115.77	x	0.63	x	0.7	=	70.76	(80)
West	0.9x	0.77	x	2	x	115.77	x	0.63	x	0.7	=	70.76	(80)
West	0.9x	0.77	x	2	x	110.22	x	0.63	x	0.7	=	67.37	(80)
West	0.9x	0.77	x	2	x	110.22	x	0.63	x	0.7	=	67.37	(80)
West	0.9x	0.77	x	2	x	110.22	x	0.63	x	0.7	=	67.37	(80)
West	0.9x	0.77	x	2	x	94.68	x	0.63	x	0.7	=	57.87	(80)
West	0.9x	0.77	x	2	x	94.68	x	0.63	x	0.7	=	57.87	(80)
West	0.9x	0.77	x	2	x	94.68	x	0.63	x	0.7	=	57.87	(80)
West	0.9x	0.77	x	2	x	73.59	x	0.63	x	0.7	=	44.98	(80)
West	0.9x	0.77	x	2	x	73.59	x	0.63	x	0.7	=	44.98	(80)
West	0.9x	0.77	x	2	x	73.59	x	0.63	x	0.7	=	44.98	(80)
West	0.9x	0.77	x	2	x	45.59	x	0.63	x	0.7	=	27.87	(80)
West	0.9x	0.77	x	2	x	45.59	x	0.63	x	0.7	=	27.87	(80)
West	0.9x	0.77	x	2	x	45.59	x	0.63	x	0.7	=	27.87	(80)
West	0.9x	0.77	x	2	x	24.49	x	0.63	x	0.7	=	14.97	(80)

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West	0.9x	0.77	x	2	x	24.49	x	0.63	x	0.7	=	14.97	(80)
West	0.9x	0.77	x	2	x	24.49	x	0.63	x	0.7	=	14.97	(80)
West	0.9x	0.77	x	2	x	16.15	x	0.63	x	0.7	=	9.87	(80)
West	0.9x	0.77	x	2	x	16.15	x	0.63	x	0.7	=	9.87	(80)
West	0.9x	0.77	x	2	x	16.15	x	0.63	x	0.7	=	9.87	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	108.31	188.86	266.85	339.68	385.01	383.24	369.13	335.81	292.5	211.31	130.6	92.09	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	434.18	513.03	581.06	637.93	667.32	649.96	625.59	597.15	561.9	496.84	434.66	409.8	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.91	0.81	0.65	0.48	0.53	0.75	0.94	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.67	19.87	20.17	20.52	20.79	20.95	20.99	20.98	20.89	20.53	20.03	19.63	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.78	19.78	19.79	19.8	19.8	19.81	19.81	19.81	19.81	19.8	19.8	19.79	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.89	0.75	0.54	0.36	0.4	0.66	0.91	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.05	18.35	18.77	19.26	19.61	19.78	19.8	19.8	19.73	19.29	18.58	18	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.86	19.11	19.47	19.89	20.2	20.36	20.4	20.39	20.31	19.91	19.31	18.81	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.86	19.11	19.47	19.89	20.2	20.36	20.4	20.39	20.31	19.91	19.31	18.81	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.89	0.77	0.59	0.42	0.46	0.7	0.91	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	428.81	500.33	551.32	566.76	516.2	385.93	264.23	275.93	395.79	452.74	424.29	405.75	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1053.2	1025.73	934.3	783.71	605.06	406.3	267.76	281.2	439.35	662.31	871.99	1048.31	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	464.55	353.07	284.94	156.21	66.11	0	0	0	0	155.92	322.34	478.07	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 2281.21 (98)

Space heating requirement in kWh/m²/year 43.37 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	464.55	353.07	284.94	156.21	66.11	0	0	0	0	155.92	322.34	478.07		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	496.84	377.61	304.74	167.07	70.7	0	0	0	0	166.76	344.75	511.3		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2439.79	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	170.83	150.75	158.72	142.85	140.39	126.03	121.6	132.66	132.19	148.1	155.89	166.91		
Efficiency of water heater													79.8	(216)
(217)m=	87.35	87.01	86.36	85.05	82.94	79.8	79.8	79.8	79.8	84.95	86.71	87.46		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	195.57	173.25	183.8	167.95	169.27	157.94	152.38	166.24	165.65	174.33	179.78	190.83		
Total = Sum(219a)$_{1...12}$ =													2077	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2439.79	
Water heating fuel used			2077	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			243.08	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	527	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	448.63	(264)
Space and water heating	(261) + (262) + (263) + (264) =				975.63	(265)

TER WorkSheet: New dwelling design stage

Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	126.16	(268)
Total CO2, kg/year		sum of (265)…(271) =		1140.71	(272)

TER =	21.69	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b2-13-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.5	(1a) x	2.4	(2a) =	121.2	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.2	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 6			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	37.87	15.64	22.23	x	0.18	=	4			(29)
Walls Type2	19.95	2.1	17.85	x	0.18	=	3.21			(29)
Roof	50.5	0	50.5	x	0.11	=	5.55			(30)
Total area of elements, m²			108.32							(31)
Party wall			17.92	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	33.2	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	15.1	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss	(33) + (36) =	48.3	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20	20	20	20	20	20	20	20	20	20	20	20	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	68.29	68.29	68.29	68.29	68.29	68.29	68.29	68.29	68.29	68.29	68.29	68.29	

Average = Sum(39)$_{1...12}$ /12= 68.29 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	

Average = Sum(40)$_{1...12}$ /12= 1.35 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.69 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.16	79.17	76.18	73.2	70.21	67.22	67.22	70.21	73.2	76.18	79.17	82.16	

Total = Sum(44)$_{1...12}$ = 896.28 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.84	106.56	109.96	95.87	91.99	79.38	73.56	84.41	85.41	99.54	108.66	117.99	

Total = Sum(45)$_{1...12}$ = 1175.16 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.28	15.98	16.49	14.38	13.8	11.91	11.03	12.66	12.81	14.93	16.3	17.7	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		0	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)			
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)			
Water storage loss:			
a) If manufacturer’s declared loss factor is known (kWh/day):		0	(48)
Temperature factor from Table 2b		0	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	110	(50)
b) If manufacturer’s declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0.02	(51)
If community heating see section 4.3			
Volume factor from Table 2a		1.03	(52)
Temperature factor from Table 2b		0.6	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	1.03	(54)
Enter (50) or (54) in (55)		1.03	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	177.12	156.49	165.24	149.36	147.26	132.87	128.83	139.68	138.91	154.82	162.15	173.27	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	177.12	156.49	165.24	149.36	147.26	132.87	128.83	139.68	138.91	154.82	162.15	173.27

Output from water heater (annual)$_{1\ldots12}$ | 1826 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.73	75.37	80.78	74.67	74.81	69.19	68.68	72.29	71.19	77.32	78.92	83.45	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.24	11.76	9.56	7.24	5.41	4.57	4.94	6.42	8.61	10.94	12.77	13.61	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.53	150.07	146.19	137.92	127.48	117.67	111.12	109.58	113.46	121.73	132.17	141.98	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	(71)

Water heating gains (Table 5)

(72)m=	113.89	112.16	108.58	103.71	100.55	96.09	92.31	97.16	98.88	103.92	109.62	112.17	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	324.24	322.57	312.91	297.44	282.02	266.91	256.94	261.73	269.53	285.17	303.12	316.33	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)

West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	66.77	129.64	215.67	324.96	412.01	428.9	405.33	338.18	253.61	153.99	82.97	55.16	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	391.01	452.21	528.58	622.41	694.02	695.81	662.27	599.9	523.14	439.15	386.09	371.49	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.99	0.97	0.91	0.78	0.6	0.45	0.51	0.77	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.65	19.83	20.14	20.53	20.83	20.96	20.99	20.98	20.88	20.48	19.98	19.61	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.88	0.71	0.5	0.33	0.38	0.68	0.93	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.04	18.3	18.75	19.28	19.65	19.78	19.8	19.79	19.71	19.22	18.52	17.97	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.84	19.06	19.44	19.91	20.24	20.37	20.39	20.39	20.29	19.85	19.25	18.79	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.84	19.06	19.44	19.91	20.24	20.37	20.39	20.39	20.29	19.85	19.25	18.79	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.88	0.74	0.55	0.39	0.45	0.72	0.93	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	387.15	443.74	505.3	549.94	512.52	379.45	256.61	267.85	376.79	407.99	378.98	368.51	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	993.35	967.25	884.08	751.86	583.11	393.91	259.11	272.45	423.06	631.56	829.85	996.3	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	451.01	351.8	281.81	145.38	52.52	0	0	0	0	166.33	324.62	467.08	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 2240.55 (98)

Space heating requirement in kWh/m²/year 44.37 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)

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Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2240.55	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1764.44	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	588.15	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1826	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1437.97	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	479.32	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	42.7	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		32.68	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	32.68	(331)
Energy for lighting (calculated in Appendix L)		233.85	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4643.25	x	0.22		1002.94	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1485.84	x	0.52		-771.15	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	3784.14	x	0.22		817.38	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1210.93	x	0.52		-628.47	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	247.93	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	22.16	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	690.78	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					690.78	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	16.96	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	121.37	(379)
Total CO2, kg/year	sum of (376)…(382) =			829.11	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.42	(384)
EI rating (section 14)				88.37	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-13-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.5	(1a) x	2.4	(2a) =	121.2	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.2	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.86	x1/[1/(1.4)+ 0.04]		=	2.47			(27)
Windows Type 2			1.86	x1/[1/(1.4)+ 0.04]		=	2.47			(27)
Windows Type 3			1.86	x1/[1/(1.4)+ 0.04]		=	2.47			(27)
Windows Type 4			1.86	x1/[1/(1.4)+ 0.04]		=	2.47			(27)
Windows Type 5			1.86	x1/[1/(1.4)+ 0.04]		=	2.47			(27)
Windows Type 6			1.24	x1/[1/(1.4)+ 0.04]		=	1.64			(27)
Walls Type1	37.87	10.54	27.33	x	0.18	=	4.92			(29)
Walls Type2	19.95	2.1	17.85	x	0.18	=	3.21			(29)
Roof	50.5	0	50.5	x	0.13	=	6.56			(30)
Total area of elements, m²			108.32							(31)
Party wall			17.92	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	30.77	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	16.87	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

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Total fabric heat loss	(33) + (36) =	47.65	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	24.04	23.89	23.73	23.01	22.87	22.24	22.24	22.13	22.49	22.87	23.15	23.43	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	71.69	71.53	71.38	70.65	70.52	69.89	69.89	69.77	70.13	70.52	70.79	71.08	

Average = Sum(39)1…12 /12= 70.65 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.42	1.42	1.41	1.4	1.4	1.38	1.38	1.38	1.39	1.4	1.4	1.41	

Average = Sum(40)1…12 /12= 1.4 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.69 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	82.16	79.17	76.18	73.2	70.21	67.22	67.22	70.21	73.2	76.18	79.17	82.16	

Total = Sum(44)1…12 = 896.28 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.84	106.56	109.96	95.87	91.99	79.38	73.56	84.41	85.41	99.54	108.66	117.99	

Total = Sum(45)1…12 = 1175.16 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.28	15.98	16.49	14.38	13.8	11.91	11.03	12.66	12.81	14.93	16.3	17.7	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):		1.39	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0.75	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.75	(55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.43	148.65	156.56	140.96	138.58	124.47	120.15	131	130.51	146.14	153.75	164.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.43	148.65	156.56	140.96	138.58	124.47	120.15	131	130.51	146.14	153.75	164.59	

Output from water heater (annual)1…12 | 1723.78 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.79	69.1	73.84	67.95	67.86	62.47	61.73	65.34	64.47	70.37	72.2	76.51	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.28	11.8	9.6	7.26	5.43	4.58	4.95	6.44	8.64	10.97	12.81	13.65	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.53	150.07	146.19	137.92	127.48	117.67	111.12	109.58	113.46	121.73	132.17	141.98	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	(71)

Water heating gains (Table 5)

(72)m=	104.55	102.83	99.24	94.37	91.21	86.76	82.97	87.82	89.55	94.59	100.28	102.83	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	317.94	316.27	306.6	291.13	275.7	260.59	250.62	255.41	263.22	278.86	296.83	310.04	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.86	x	10.63	x	0.63	x	0.7	=	6.04	(74)
North	0.9x	0.77	x	1.86	x	10.63	x	0.63	x	0.7	=	6.04	(74)
North	0.9x	0.77	x	1.24	x	10.63	x	0.63	x	0.7	=	4.03	(74)
North	0.9x	0.77	x	1.86	x	20.32	x	0.63	x	0.7	=	11.55	(74)
North	0.9x	0.77	x	1.86	x	20.32	x	0.63	x	0.7	=	11.55	(74)
North	0.9x	0.77	x	1.24	x	20.32	x	0.63	x	0.7	=	7.7	(74)
North	0.9x	0.77	x	1.86	x	34.53	x	0.63	x	0.7	=	19.63	(74)
North	0.9x	0.77	x	1.86	x	34.53	x	0.63	x	0.7	=	19.63	(74)
North	0.9x	0.77	x	1.24	x	34.53	x	0.63	x	0.7	=	13.09	(74)
North	0.9x	0.77	x	1.86	x	55.46	x	0.63	x	0.7	=	31.53	(74)
North	0.9x	0.77	x	1.86	x	55.46	x	0.63	x	0.7	=	31.53	(74)
North	0.9x	0.77	x	1.24	x	55.46	x	0.63	x	0.7	=	21.02	(74)
North	0.9x	0.77	x	1.86	x	74.72	x	0.63	x	0.7	=	42.47	(74)
North	0.9x	0.77	x	1.86	x	74.72	x	0.63	x	0.7	=	42.47	(74)
North	0.9x	0.77	x	1.24	x	74.72	x	0.63	x	0.7	=	28.31	(74)
North	0.9x	0.77	x	1.86	x	79.99	x	0.63	x	0.7	=	45.47	(74)
North	0.9x	0.77	x	1.86	x	79.99	x	0.63	x	0.7	=	45.47	(74)
North	0.9x	0.77	x	1.24	x	79.99	x	0.63	x	0.7	=	30.31	(74)
North	0.9x	0.77	x	1.86	x	74.68	x	0.63	x	0.7	=	42.45	(74)
North	0.9x	0.77	x	1.86	x	74.68	x	0.63	x	0.7	=	42.45	(74)
North	0.9x	0.77	x	1.24	x	74.68	x	0.63	x	0.7	=	28.3	(74)
North	0.9x	0.77	x	1.86	x	59.25	x	0.63	x	0.7	=	33.68	(74)
North	0.9x	0.77	x	1.86	x	59.25	x	0.63	x	0.7	=	33.68	(74)
North	0.9x	0.77	x	1.24	x	59.25	x	0.63	x	0.7	=	22.45	(74)
North	0.9x	0.77	x	1.86	x	41.52	x	0.63	x	0.7	=	23.6	(74)
North	0.9x	0.77	x	1.86	x	41.52	x	0.63	x	0.7	=	23.6	(74)
North	0.9x	0.77	x	1.24	x	41.52	x	0.63	x	0.7	=	15.73	(74)
North	0.9x	0.77	x	1.86	x	24.19	x	0.63	x	0.7	=	13.75	(74)
North	0.9x	0.77	x	1.86	x	24.19	x	0.63	x	0.7	=	13.75	(74)
North	0.9x	0.77	x	1.24	x	24.19	x	0.63	x	0.7	=	9.17	(74)
North	0.9x	0.77	x	1.86	x	13.12	x	0.63	x	0.7	=	7.46	(74)
North	0.9x	0.77	x	1.86	x	13.12	x	0.63	x	0.7	=	7.46	(74)
North	0.9x	0.77	x	1.24	x	13.12	x	0.63	x	0.7	=	4.97	(74)
North	0.9x	0.77	x	1.86	x	8.86	x	0.63	x	0.7	=	5.04	(74)
North	0.9x	0.77	x	1.86	x	8.86	x	0.63	x	0.7	=	5.04	(74)
North	0.9x	0.77	x	1.24	x	8.86	x	0.63	x	0.7	=	3.36	(74)
West	0.9x	0.77	x	1.86	x	19.64	x	0.63	x	0.7	=	11.16	(80)
West	0.9x	0.77	x	1.86	x	19.64	x	0.63	x	0.7	=	11.16	(80)
West	0.9x	0.77	x	1.86	x	19.64	x	0.63	x	0.7	=	11.16	(80)

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West	0.9x	0.77	x	1.86	x	38.42	x	0.63	x	0.7	=	21.84	(80)
West	0.9x	0.77	x	1.86	x	38.42	x	0.63	x	0.7	=	21.84	(80)
West	0.9x	0.77	x	1.86	x	38.42	x	0.63	x	0.7	=	21.84	(80)
West	0.9x	0.77	x	1.86	x	63.27	x	0.63	x	0.7	=	35.97	(80)
West	0.9x	0.77	x	1.86	x	63.27	x	0.63	x	0.7	=	35.97	(80)
West	0.9x	0.77	x	1.86	x	63.27	x	0.63	x	0.7	=	35.97	(80)
West	0.9x	0.77	x	1.86	x	92.28	x	0.63	x	0.7	=	52.46	(80)
West	0.9x	0.77	x	1.86	x	92.28	x	0.63	x	0.7	=	52.46	(80)
West	0.9x	0.77	x	1.86	x	92.28	x	0.63	x	0.7	=	52.46	(80)
West	0.9x	0.77	x	1.86	x	113.09	x	0.63	x	0.7	=	64.29	(80)
West	0.9x	0.77	x	1.86	x	113.09	x	0.63	x	0.7	=	64.29	(80)
West	0.9x	0.77	x	1.86	x	113.09	x	0.63	x	0.7	=	64.29	(80)
West	0.9x	0.77	x	1.86	x	115.77	x	0.63	x	0.7	=	65.81	(80)
West	0.9x	0.77	x	1.86	x	115.77	x	0.63	x	0.7	=	65.81	(80)
West	0.9x	0.77	x	1.86	x	115.77	x	0.63	x	0.7	=	65.81	(80)
West	0.9x	0.77	x	1.86	x	110.22	x	0.63	x	0.7	=	62.65	(80)
West	0.9x	0.77	x	1.86	x	110.22	x	0.63	x	0.7	=	62.65	(80)
West	0.9x	0.77	x	1.86	x	110.22	x	0.63	x	0.7	=	62.65	(80)
West	0.9x	0.77	x	1.86	x	94.68	x	0.63	x	0.7	=	53.82	(80)
West	0.9x	0.77	x	1.86	x	94.68	x	0.63	x	0.7	=	53.82	(80)
West	0.9x	0.77	x	1.86	x	94.68	x	0.63	x	0.7	=	53.82	(80)
West	0.9x	0.77	x	1.86	x	73.59	x	0.63	x	0.7	=	41.83	(80)
West	0.9x	0.77	x	1.86	x	73.59	x	0.63	x	0.7	=	41.83	(80)
West	0.9x	0.77	x	1.86	x	73.59	x	0.63	x	0.7	=	41.83	(80)
West	0.9x	0.77	x	1.86	x	45.59	x	0.63	x	0.7	=	25.91	(80)
West	0.9x	0.77	x	1.86	x	45.59	x	0.63	x	0.7	=	25.91	(80)
West	0.9x	0.77	x	1.86	x	45.59	x	0.63	x	0.7	=	25.91	(80)
West	0.9x	0.77	x	1.86	x	24.49	x	0.63	x	0.7	=	13.92	(80)
West	0.9x	0.77	x	1.86	x	24.49	x	0.63	x	0.7	=	13.92	(80)
West	0.9x	0.77	x	1.86	x	24.49	x	0.63	x	0.7	=	13.92	(80)
West	0.9x	0.77	x	1.86	x	16.15	x	0.63	x	0.7	=	9.18	(80)
West	0.9x	0.77	x	1.86	x	16.15	x	0.63	x	0.7	=	9.18	(80)
West	0.9x	0.77	x	1.86	x	16.15	x	0.63	x	0.7	=	9.18	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	49.61	96.32	160.24	241.44	306.12	318.67	301.16	251.26	188.43	114.41	61.65	40.98	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	367.55	412.6	466.85	532.57	581.81	579.26	551.78	506.67	451.65	393.28	358.48	351.02	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	1	0.99	0.98	0.95	0.86	0.7	0.54	0.6	0.84	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.53	19.68	19.98	20.38	20.72	20.92	20.98	20.97	20.81	20.37	19.88	19.5	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.75	19.75	19.75	19.76	19.77	19.78	19.78	19.78	19.77	19.77	19.76	19.76	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.93	0.8	0.59	0.4	0.46	0.76	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.82	18.05	18.48	19.05	19.5	19.73	19.77	19.77	19.63	19.06	18.35	17.79	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.67	18.87	19.23	19.71	20.11	20.32	20.37	20.37	20.22	19.71	19.12	18.64	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.67	18.87	19.23	19.71	20.11	20.32	20.37	20.37	20.22	19.71	19.12	18.64	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.92	0.82	0.64	0.47	0.53	0.79	0.95	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	364.62	406.99	453.26	492.61	476.84	371.27	258.11	267.37	357.36	373.49	353.39	348.7	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1030.45	999.11	908.41	763.95	593.09	400.01	263.8	276.79	429.21	642.69	850.67	1026.71	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	495.38	397.9	338.63	195.37	86.49	0	0	0	0	200.28	358.04	504.44	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2576.54 (98)

Space heating requirement in kWh/m²/year 51.02 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	495.38	397.9	338.63	195.37	86.49	0	0	0	0	200.28	358.04	504.44	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	529.82	425.57	362.17	208.95	92.51	0	0	0	0	214.21	382.93	539.51	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2755.65 (211)

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Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

168.43	148.65	156.56	140.96	138.58	124.47	120.15	131	130.51	146.14	153.75	164.59

Efficiency of water heater 79.8 (216)

(217)m=	87.52	87.32	86.82	85.68	83.6	79.8	79.8	79.8	79.8	85.66	87	87.61	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	192.45	170.24	180.32	164.51	165.77	155.98	150.56	164.16	163.54	170.61	176.73	187.87

Total = Sum(219a)$_{1...12}$ = 2042.74 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2755.65	
Water heating fuel used			2042.74	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			234.6	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	595.22	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	441.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1036.45	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	121.76	(268)
Total CO2, kg/year			sum of (265)…(271) =		1197.14	(272)

TER = 23.71 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-2-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.98	(1a) x	2.4	(2a) =	172.75	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.98	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	172.75	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 2			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Floor			71.98	x	0.11	=	7.9178			(28)
Walls Type1	41.71	17.94	23.77	x	0.18	=	4.28			(29)
Walls Type2	11.24	2.1	9.14	x	0.18	=	1.65			(29)
Total area of elements, m²			124.93							(31)
Party wall			43.65	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 36.9 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.75 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 51.65 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	80.15	80.15	80.15	80.15	80.15	80.15	80.15	80.15	80.15	80.15	80.15	80.15	

Average = Sum(39)$_{1…12}$ /12= 80.15 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	

Average = Sum(40)$_{1…12}$ /12= 1.11 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.29 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.66 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	97.53	93.98	90.44	86.89	83.34	79.8	79.8	83.34	86.89	90.44	93.98	97.53	

Total = Sum(44)$_{1…12}$ = 1063.97 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.63	126.5	130.54	113.8	109.2	94.23	87.32	100.2	101.39	118.17	128.99	140.07	

Total = Sum(45)$_{1…12}$ = 1395.03 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.7	18.97	19.58	17.07	16.38	14.13	13.1	15.03	15.21	17.72	19.35	21.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.91	176.43	185.81	167.3	164.47	147.72	142.59	155.47	154.89	173.44	182.48	195.35	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.91	176.43	185.81	167.3	164.47	147.72	142.59	155.47	154.89	173.44	182.48	195.35

Output from water heater (annual)$_{1…12}$ | 2045.87 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.31	82	87.62	80.63	80.53	74.13	73.25	77.54	76.51	83.51	85.68	90.8	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18	15.98	13	9.84	7.36	6.21	6.71	8.72	11.71	14.87	17.35	18.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	201.87	203.97	198.69	187.45	173.27	159.93	151.03	148.93	154.21	165.45	179.63	192.97	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	(71)

Water heating gains (Table 5)

(72)m=	124.08	122.03	117.77	111.99	108.24	102.95	98.46	104.22	106.26	112.25	119	122.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	401.34	399.38	386.86	366.68	346.26	326.49	313.59	319.27	329.58	349.96	373.39	390.9	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)

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North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
East	0.9x	1	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(76)
East	0.9x	1	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(76)
East	0.9x	1	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(76)
East	0.9x	1	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(76)
East	0.9x	1	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(76)
East	0.9x	1	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(76)
East	0.9x	1	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(76)
East	0.9x	1	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(76)
East	0.9x	1	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(76)
East	0.9x	1	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(76)
East	0.9x	1	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(76)
East	0.9x	1	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	66.09	127.6	213.87	329.81	427.83	450.24	423.48	346.58	253.49	151.67	81.91	54.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	467.43	526.98	600.73	696.49	774.09	776.73	737.08	665.85	583.07	501.63	455.3	445.67	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.82	0.63	0.47	0.54	0.81	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.85	19.99	20.25	20.59	20.86	20.97	20.99	20.99	20.9	20.54	20.13	19.82	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.77	0.54	0.37	0.43	0.74	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.47	18.67	19.04	19.51	19.85	19.97	19.99	19.99	19.91	19.46	18.87	18.41	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.02	19.2	19.52	19.94	20.26	20.37	20.39	20.39	20.3	19.9	19.37	18.97	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.02	19.2	19.52	19.94	20.26	20.37	20.39	20.39	20.3	19.9	19.37	18.97	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.92	0.78	0.58	0.41	0.47	0.76	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	465.04	521.76	585.47	640.6	606.07	449.11	301.97	315.77	445.77	478.29	450.66	443.86	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1179.97	1146.08	1043.9	885.14	685.73	462.58	303.82	319.58	497.34	745.09	983.88	1184.03	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	531.91	419.55	341.08	176.07	59.27	0	0	0	0	198.5	383.92	550.69	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2660.98 (98)

Space heating requirement in kWh/m²/year 36.97 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2660.98	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	2095.52	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	698.51	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2045.87	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1611.12	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	537.04	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	49.42	(313)

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Cooling System Energy Efficiency Ratio			0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =		0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside			46.58	(330a)
warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =		46.58	(331)
Energy for lighting (calculated in Appendix L)			317.84	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	5514.53	x	0.22		1191.14	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1764.65	x	0.52		-915.85	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4239.79	x	0.22		915.8	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1356.73	x	0.52		-704.15	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	286.97	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	25.65	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	799.55	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					799.55	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	24.17	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	164.96	(379)
Total CO2, kg/year	sum of (376)…(382) =					988.68	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					13.74	(384)
EI rating (section 14)						88.67	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-2-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.98	(1a) x	2.4	(2a) =	172.75	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.98	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	172.75	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.69	x1/[1/(1.4)+ 0.04]		=	6.22			(27)
Windows Type 2			4.69	x1/[1/(1.4)+ 0.04]		=	6.22			(27)
Windows Type 3			2.45	x1/[1/(1.4)+ 0.04]		=	3.25			(27)
Windows Type 4			2.45	x1/[1/(1.4)+ 0.04]		=	3.25			(27)
Windows Type 5			1.63	x1/[1/(1.4)+ 0.04]		=	2.16			(27)
Floor			71.98	x	0.13	=	9.3574			(28)
Walls Type1	41.71	15.91	25.8	x	0.18	=	4.64			(29)
Walls Type2	11.24	2.1	9.14	x	0.18	=	1.65			(29)
Total area of elements, m²			124.93							(31)
Party wall			43.65	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	38.84	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		12.16	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	51	(37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.51	34.28	34.05	32.98	32.78	31.84	31.84	31.67	32.2	32.78	33.18	33.61	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	85.51	85.27	85.05	83.97	83.77	82.84	82.84	82.66	83.2	83.77	84.18	84.6	

Average = Sum(39)1…12 /12= 83.97 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.19	1.18	1.18	1.17	1.16	1.15	1.15	1.15	1.16	1.16	1.17	1.18	

Average = Sum(40)1…12 /12= 1.17 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.29 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.66 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	97.53	93.98	90.44	86.89	83.34	79.8	79.8	83.34	86.89	90.44	93.98	97.53	

Total = Sum(44)1…12 = 1063.97 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.63	126.5	130.54	113.8	109.2	94.23	87.32	100.2	101.39	118.17	128.99	140.07	

Total = Sum(45)1…12 = 1395.03 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.7	18.97	19.58	17.07	16.38	14.13	13.1	15.03	15.21	17.72	19.35	21.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.23	168.58	177.13	158.9	155.79	139.32	133.91	146.79	146.49	164.76	174.08	186.67	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.23	168.58	177.13	158.9	155.79	139.32	133.91	146.79	146.49	164.76	174.08	186.67

Output from water heater (annual)$_{1...12}$ — 1943.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.37	75.73	80.68	73.91	73.58	67.4	66.31	70.59	69.79	76.57	78.96	83.85	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18	15.99	13	9.84	7.36	6.21	6.71	8.73	11.71	14.87	17.36	18.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	201.87	203.97	198.69	187.45	173.27	159.93	151.03	148.93	154.21	165.45	179.63	192.97	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	(71)

Water heating gains (Table 5)

(72)m=	114.74	112.69	108.44	102.66	98.9	93.62	89.12	94.88	96.93	102.91	109.67	112.7	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	395.01	393.05	380.53	360.35	339.93	320.16	307.26	312.93	323.24	343.63	367.06	384.57	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	4.69	x	10.63	x	0.63	x	0.7	=	15.24	(74)
North	0.9x	0.77	x	2.45	x	10.63	x	0.63	x	0.7	=	7.96	(74)
North	0.9x	0.77	x	2.45	x	10.63	x	0.63	x	0.7	=	7.96	(74)
North	0.9x	0.77	x	1.63	x	10.63	x	0.63	x	0.7	=	5.3	(74)
North	0.9x	0.77	x	4.69	x	20.32	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.45	x	20.32	x	0.63	x	0.7	=	15.22	(74)
North	0.9x	0.77	x	2.45	x	20.32	x	0.63	x	0.7	=	15.22	(74)
North	0.9x	0.77	x	1.63	x	20.32	x	0.63	x	0.7	=	10.12	(74)
North	0.9x	0.77	x	4.69	x	34.53	x	0.63	x	0.7	=	49.49	(74)
North	0.9x	0.77	x	2.45	x	34.53	x	0.63	x	0.7	=	25.85	(74)
North	0.9x	0.77	x	2.45	x	34.53	x	0.63	x	0.7	=	25.85	(74)
North	0.9x	0.77	x	1.63	x	34.53	x	0.63	x	0.7	=	17.2	(74)
North	0.9x	0.77	x	4.69	x	55.46	x	0.63	x	0.7	=	79.5	(74)
North	0.9x	0.77	x	2.45	x	55.46	x	0.63	x	0.7	=	41.53	(74)
North	0.9x	0.77	x	2.45	x	55.46	x	0.63	x	0.7	=	41.53	(74)
North	0.9x	0.77	x	1.63	x	55.46	x	0.63	x	0.7	=	27.63	(74)
North	0.9x	0.77	x	4.69	x	74.72	x	0.63	x	0.7	=	107.09	(74)
North	0.9x	0.77	x	2.45	x	74.72	x	0.63	x	0.7	=	55.94	(74)
North	0.9x	0.77	x	2.45	x	74.72	x	0.63	x	0.7	=	55.94	(74)
North	0.9x	0.77	x	1.63	x	74.72	x	0.63	x	0.7	=	37.22	(74)
North	0.9x	0.77	x	4.69	x	79.99	x	0.63	x	0.7	=	114.65	(74)
North	0.9x	0.77	x	2.45	x	79.99	x	0.63	x	0.7	=	59.89	(74)
North	0.9x	0.77	x	2.45	x	79.99	x	0.63	x	0.7	=	59.89	(74)
North	0.9x	0.77	x	1.63	x	79.99	x	0.63	x	0.7	=	39.84	(74)
North	0.9x	0.77	x	4.69	x	74.68	x	0.63	x	0.7	=	107.04	(74)
North	0.9x	0.77	x	2.45	x	74.68	x	0.63	x	0.7	=	55.91	(74)
North	0.9x	0.77	x	2.45	x	74.68	x	0.63	x	0.7	=	55.91	(74)
North	0.9x	0.77	x	1.63	x	74.68	x	0.63	x	0.7	=	37.2	(74)
North	0.9x	0.77	x	4.69	x	59.25	x	0.63	x	0.7	=	84.92	(74)
North	0.9x	0.77	x	2.45	x	59.25	x	0.63	x	0.7	=	44.36	(74)
North	0.9x	0.77	x	2.45	x	59.25	x	0.63	x	0.7	=	44.36	(74)
North	0.9x	0.77	x	1.63	x	59.25	x	0.63	x	0.7	=	29.51	(74)
North	0.9x	0.77	x	4.69	x	41.52	x	0.63	x	0.7	=	59.51	(74)
North	0.9x	0.77	x	2.45	x	41.52	x	0.63	x	0.7	=	31.09	(74)
North	0.9x	0.77	x	2.45	x	41.52	x	0.63	x	0.7	=	31.09	(74)
North	0.9x	0.77	x	1.63	x	41.52	x	0.63	x	0.7	=	20.68	(74)
North	0.9x	0.77	x	4.69	x	24.19	x	0.63	x	0.7	=	34.67	(74)
North	0.9x	0.77	x	2.45	x	24.19	x	0.63	x	0.7	=	18.11	(74)
North	0.9x	0.77	x	2.45	x	24.19	x	0.63	x	0.7	=	18.11	(74)
North	0.9x	0.77	x	1.63	x	24.19	x	0.63	x	0.7	=	12.05	(74)
North	0.9x	0.77	x	4.69	x	13.12	x	0.63	x	0.7	=	18.8	(74)

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North	0.9x	0.77	x	2.45	x	13.12	x	0.63	x	0.7	=	9.82	(74)
North	0.9x	0.77	x	2.45	x	13.12	x	0.63	x	0.7	=	9.82	(74)
North	0.9x	0.77	x	1.63	x	13.12	x	0.63	x	0.7	=	6.53	(74)
North	0.9x	0.77	x	4.69	x	8.86	x	0.63	x	0.7	=	12.71	(74)
North	0.9x	0.77	x	2.45	x	8.86	x	0.63	x	0.7	=	6.64	(74)
North	0.9x	0.77	x	2.45	x	8.86	x	0.63	x	0.7	=	6.64	(74)
North	0.9x	0.77	x	1.63	x	8.86	x	0.63	x	0.7	=	4.42	(74)
East	0.9x	1	x	4.69	x	19.64	x	0.63	x	0.7	=	28.15	(76)
East	0.9x	1	x	4.69	x	38.42	x	0.63	x	0.7	=	55.07	(76)
East	0.9x	1	x	4.69	x	63.27	x	0.63	x	0.7	=	90.69	(76)
East	0.9x	1	x	4.69	x	92.28	x	0.63	x	0.7	=	132.27	(76)
East	0.9x	1	x	4.69	x	113.09	x	0.63	x	0.7	=	162.1	(76)
East	0.9x	1	x	4.69	x	115.77	x	0.63	x	0.7	=	165.94	(76)
East	0.9x	1	x	4.69	x	110.22	x	0.63	x	0.7	=	157.98	(76)
East	0.9x	1	x	4.69	x	94.68	x	0.63	x	0.7	=	135.7	(76)
East	0.9x	1	x	4.69	x	73.59	x	0.63	x	0.7	=	105.48	(76)
East	0.9x	1	x	4.69	x	45.59	x	0.63	x	0.7	=	65.34	(76)
East	0.9x	1	x	4.69	x	24.49	x	0.63	x	0.7	=	35.1	(76)
East	0.9x	1	x	4.69	x	16.15	x	0.63	x	0.7	=	23.15	(76)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	64.61	124.75	209.09	322.45	418.3	440.2	414.04	338.86	247.84	148.29	80.08	53.55	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	459.63	517.8	589.62	682.8	758.22	760.37	721.3	651.79	571.08	491.92	447.14	438.11	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.95	0.84	0.66	0.5	0.57	0.84	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.74	19.89	20.15	20.52	20.82	20.96	20.99	20.99	20.87	20.49	20.06	19.72	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.93	19.93	19.95	19.95	19.96	19.96	19.96	19.96	19.95	19.94	19.94	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.79	0.57	0.38	0.45	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.26	18.47	18.86	19.39	19.78	19.93	19.96	19.96	19.86	19.36	18.73	18.24	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.85	19.04	19.38	19.84	20.19	20.35	20.37	20.37	20.26	19.81	19.26	18.83	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.85	19.04	19.38	19.84	20.19	20.35	20.37	20.37	20.26	19.81	19.26	18.83	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.81	0.6	0.43	0.5	0.79	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	457.41	513.1	576.34	634.48	610.49	457.94	309.7	322.75	448.62	471.56	442.96	436.43	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1244.56	1205.76	1095.34	918.94	711.49	475.93	312.37	327.98	512.7	771.54	1023.7	1237.85	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	585.64	465.47	386.14	204.81	75.14	0	0	0	0	223.18	418.13	596.26	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2954.76 (98)

Space heating requirement in kWh/m²/year 41.05 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	585.64	465.47	386.14	204.81	75.14	0	0	0	0	223.18	418.13	596.26	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	626.35	497.83	412.98	219.05	80.36	0	0	0	0	238.7	447.2	637.71	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3160.17 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)													
	191.23	168.58	177.13	158.9	155.79	139.32	133.91	146.79	146.49	164.76	174.08	186.67	
Efficiency of water heater												79.8	(216)
(217)m=	87.61	87.38	86.84	85.49	82.99	79.8	79.8	79.8	79.8	85.62	87.07	87.7	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	218.28	192.92	203.98	185.86	187.72	174.59	167.81	183.95	183.57	192.42	199.93	212.85	

Total = Sum(219a)$_{1...12}$ = 2303.88 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3160.17

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Water heating fuel used			2303.88	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			317.9	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	682.6	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	497.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1180.23	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	164.99	(268)
Total CO2, kg/year		sum of (265)…(271) =		1384.15	(272)
TER =				19.23	(273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-2-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.81	(1a) x	2.4	(2a) =	121.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.81	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Floor			50.81	x	0.11	=	5.5891			(28)
Walls Type1	17.04	7.36	9.68	x	0.18	=	1.74			(29)
Walls Type2	19.18	2.1	17.08	x	0.18	=	3.07			(29)
Total area of elements, m²			87.03							(31)
Party wall			33.09	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 21.35 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.09 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 31.45 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	51.57	51.57	51.57	51.57	51.57	51.57	51.57	51.57	51.57	51.57	51.57	51.57

Average = Sum(39)$_{1…12}$ /12= 51.57 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01

Average = Sum(40)1…12 /12= 1.01 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.91 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.4	79.4	76.4	73.41	70.41	67.42	67.42	70.41	73.41	76.4	79.4	82.4	
										Total = Sum(44)1…12 =		898.88	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	122.19	106.87	110.28	96.15	92.25	79.61	73.77	84.65	85.66	99.83	108.97	118.34	
										Total = Sum(45)1…12 =		1178.57	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.33	16.03	16.54	14.42	13.84	11.94	11.07	12.7	12.85	14.97	16.35	17.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)
If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H													
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	177.47	156.8	165.56	149.64	147.53	133.1	129.05	139.93	139.16	155.11	162.47	173.61	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	177.47	156.8	165.56	149.64	147.53	133.1	129.05	139.93	139.16	155.11	162.47	173.61	

Output from water heater (annual)$_{1...12}$ 1829.41 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.85	75.48	80.89	74.76	74.9	69.26	68.75	72.37	71.28	77.42	79.03	83.57	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	13.8	12.26	9.97	7.55	5.64	4.76	5.15	6.69	8.98	11.4	13.3	14.18	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	149.34	150.89	146.98	138.67	128.17	118.31	111.72	110.17	114.08	122.39	132.89	142.75	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	(71)
Water heating gains (Table 5)													
(72)m=	114.05	112.32	108.72	103.84	100.67	96.2	92.41	97.27	99	104.05	109.76	112.32	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	325.89	324.17	314.38	298.76	283.19	267.98	257.98	262.84	270.76	286.55	304.66	317.96	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)

East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	40.07	78.39	129.09	188.27	230.73	236.19	224.87	193.16	150.14	93.01	49.96	32.95	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	365.96	402.55	443.47	487.03	513.92	504.18	482.85	456	420.9	379.56	354.62	350.91	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.82	0.63	0.47	0.51	0.77	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.18	20.4	20.68	20.89	20.98	21	20.99	20.94	20.67	20.31	20.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.91	0.77	0.55	0.37	0.41	0.69	0.93	0.99	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.82	19	19.32	19.7	19.96	20.06	20.07	20.07	20.02	19.7	19.18	18.77	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.59	19.86	20.19	20.43	20.52	20.53	20.53	20.48	20.18	19.75	19.39	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.44	19.59	19.86	20.19	20.43	20.52	20.53	20.53	20.48	20.18	19.75	19.39	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.79	0.59	0.42	0.46	0.73	0.94	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	363.07	396.86	429.05	444.26	404	297.49	201.87	211.39	306.28	354.91	349.06	348.68	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	780.75	757.66	689.09	582.13	449.95	305.15	202.82	213.05	329.08	494.17	652.11	783.53	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	310.75	242.46	193.47	99.27	34.18	0	0	0	0	103.61	218.2	323.53	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1525.47 (98)

Space heating requirement in kWh/m²/year 30.02 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1525.47	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1201.31	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	400.44	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		1829.41	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1440.66	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	480.22	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	35.23	(313)

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Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		32.88	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	32.88	(331)
Energy for lighting (calculated in Appendix L)		243.69	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	3161.34	x	0.22		682.85	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1011.63	x	0.52		-525.03	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	3791.22	x	0.22		818.9	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1213.19	x	0.52		-629.65	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	204.54	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	18.28	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	569.89	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					569.89	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	17.06	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	126.47	(379)
Total CO2, kg/year	sum of (376)…(382) =					713.43	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					14.04	(384)
EI rating (section 14)						90.02	(385)

DRAFT

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-2-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	50.81	(1a)	x	2.4	(2a)	=	121.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.81	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			121.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Floor			50.81	x	0.13	=	6.6053			(28)
Walls Type1	17.04	7.36	9.68	x	0.18	=	1.74			(29)
Walls Type2	19.18	2.1	17.08	x	0.18	=	3.07			(29)
Total area of elements, m²			87.03							(31)
Party wall			33.09	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 23.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.32 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 31.6 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	24.17	24.01	23.86	23.14	23	22.37	22.37	22.25	22.61	23	23.27	23.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	55.77	55.61	55.46	54.74	54.6	53.97	53.97	53.85	54.21	54.6	54.87	55.16	

Average = Sum(39)$_{1…12}$ /12= 54.74 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.1	1.09	1.09	1.08	1.07	1.06	1.06	1.06	1.07	1.07	1.08	1.09

Average = Sum(40)$_{1…12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.91 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.4	79.4	76.4	73.41	70.41	67.42	67.42	70.41	73.41	76.4	79.4	82.4	
										Total = Sum(44)$_{1…12}$ =		898.88	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	122.19	106.87	110.28	96.15	92.25	79.61	73.77	84.65	85.66	99.83	108.97	118.34	
										Total = Sum(45)$_{1…12}$ =		1178.57	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.33	16.03	16.54	14.42	13.84	11.94	11.07	12.7	12.85	14.97	16.35	17.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.79	148.96	156.88	141.24	138.85	124.7	120.36	131.25	130.75	146.43	154.06	164.93	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.79	148.96	156.88	141.24	138.85	124.7	120.36	131.25	130.75	146.43	154.06	164.93	

Output from water heater (annual)$_{1\ldots12}$ 1727.19 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.91	69.2	73.94	68.04	67.95	62.54	61.8	65.42	64.56	70.47	72.31	76.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	14.18	12.59	10.24	7.75	5.8	4.89	5.29	6.87	9.22	11.71	13.67	14.57	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	149.34	150.89	146.98	138.67	128.17	118.31	111.72	110.17	114.08	122.39	132.89	142.75	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	(71)
Water heating gains (Table 5)													
(72)m=	104.71	102.98	99.39	94.5	91.33	86.87	83.07	87.93	89.66	94.72	100.43	102.99	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	319.94	318.17	308.32	292.63	277.01	261.78	251.79	256.69	264.67	280.53	298.69	312.02	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(76)

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East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	44.18	86.42	142.32	207.57	254.38	260.4	247.92	212.96	165.53	102.54	55.08	36.33	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	364.11	404.59	450.64	500.2	531.39	522.18	499.7	469.64	430.2	383.07	353.77	348.35	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.82	0.64	0.47	0.52	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.94	20.08	20.32	20.63	20.87	20.97	21	20.99	20.93	20.62	20.23	19.92	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20.01	20.01	20.02	20.02	20.03	20.03	20.03	20.03	20.02	20.02	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.91	0.77	0.55	0.37	0.41	0.7	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.6	18.8	19.16	19.6	19.9	20.02	20.03	20.03	19.97	19.59	19.03	18.57	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.27	19.44	19.74	20.12	20.38	20.49	20.51	20.51	20.45	20.11	19.63	19.24	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.27	19.44	19.74	20.12	20.38	20.49	20.51	20.51	20.45	20.11	19.63	19.24	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.99	0.97	0.91	0.79	0.59	0.42	0.47	0.74	0.94	0.99	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	361.39	399.11	436.49	457.03	419.68	309.02	209.97	219.35	316.56	359.63	348.58	346.24		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	834.81	808.6	734.2	613.98	474.02	318.14	211.19	221.44	344.21	519.17	687.56	829.87		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	352.22	275.18	221.49	113	40.42	0	0	0	0	118.7	244.07	359.82		
Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =													1724.91	(98)
Space heating requirement in kWh/m²/year													33.95	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	352.22	275.18	221.49	113	40.42	0	0	0	0	118.7	244.07	359.82		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	376.71	294.31	236.89	120.86	43.23	0	0	0	0	126.95	261.04	384.83		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1844.82	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	168.79	148.96	156.88	141.24	138.85	124.7	120.36	131.25	130.75	146.43	154.06	164.93		
Efficiency of water heater													79.8	(216)
(217)m=	86.73	86.43	85.73	84.23	81.99	79.8	79.8	79.8	79.8	84.26	86.04	86.84		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	194.61	172.34	182.98	167.69	169.36	156.27	150.83	164.47	163.85	173.78	179.07	189.93		
Total = Sum(219a)$_{1...12}$ =													2065.17	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1844.82

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Water heating fuel used			2065.17	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			250.39	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	398.48	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	446.08	(264)
Space and water heating	(261) + (262) + (263) + (264) =			844.56	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	129.95	(268)
Total CO2, kg/year		sum of (265)…(271) =		1013.44	(272)

TER = 19.95 (273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-2-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	74.09	(1a)	x	2.4	(2a)	=	177.82	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.09	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	177.82	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Floor			74.09	x	0.11	=	8.149899			(28)
Walls Type1	31	12.88	18.12	x	0.18	=	3.26			(29)
Walls Type2	31.26	2.1	29.16	x	0.18	=	5.25			(29)
Total area of elements, m²			136.35							(31)
Party wall			31.88	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.93 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.14 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 48.06 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	

Average = Sum(39)$_{1...12}$ /12= 77.4 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	

Average = Sum(40)$_{1...12}$ /12= 1.04 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.34 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.8 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	98.78	95.19	91.6	88.01	84.42	80.82	80.82	84.42	88.01	91.6	95.19	98.78	

Total = Sum(44)$_{1...12}$ = 1077.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.49	128.12	132.21	115.27	110.6	95.44	88.44	101.49	102.7	119.68	130.64	141.87	

Total = Sum(45)$_{1...12}$ = 1412.96 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.97	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.4	17.95	19.6	21.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.77	178.05	187.49	168.76	165.88	148.93	143.72	156.76	156.19	174.96	184.14	197.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.77	178.05	187.49	168.76	165.88	148.93	143.72	156.76	156.19	174.96	184.14	197.15	

Output from water heater (annual)$_{1...12}$	2063.8	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.93	82.54	88.18	81.12	81	74.53	73.63	77.97	76.94	84.02	86.23	91.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.57	16.49	13.41	10.15	7.59	6.41	6.92	9	12.08	15.34	17.9	19.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	206.65	208.79	203.39	191.89	177.36	163.72	154.6	152.45	157.86	169.36	183.88	197.53	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	(71)

Water heating gains (Table 5)

(72)m=	124.91	122.83	118.52	112.67	108.87	103.51	98.96	104.79	106.86	112.93	119.77	122.84	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	408.24	406.23	393.44	372.82	351.94	331.75	318.6	324.36	334.92	355.74	379.67	397.57	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.6	x	10.63	x	0.5	x	0.8	=	13.56	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.5	x	0.8	=	25.91	(74)

North	0.9x	0.77	x	4.6	x	34.53	x	0.5	x	0.8	=	44.03	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.5	x	0.8	=	70.72	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.5	x	0.8	=	95.27	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.5	x	0.8	=	101.99	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.5	x	0.8	=	95.22	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.5	x	0.8	=	75.55	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.5	x	0.8	=	52.94	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.5	x	0.8	=	30.84	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.5	x	0.8	=	16.73	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.5	x	0.8	=	11.3	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)

East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	58.64	114.1	189.26	282.53	354.84	367.71	348.2	292.85	221.84	135.48	72.93	48.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	466.88	520.33	582.7	655.35	706.78	699.46	666.8	617.21	556.76	491.22	452.6	445.95	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.95	0.85	0.67	0.5	0.56	0.83	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.06	20.29	20.6	20.85	20.97	20.99	20.99	20.9	20.58	20.19	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.8	0.59	0.4	0.45	0.75	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.62	18.81	19.14	19.57	19.9	20.03	20.04	20.04	19.97	19.55	19	18.57	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.14	19.31	19.6	19.98	20.28	20.4	20.42	20.42	20.34	19.96	19.48	19.1	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.14	19.31	19.6	19.98	20.28	20.4	20.42	20.42	20.34	19.96	19.48	19.1	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.82	0.62	0.44	0.5	0.78	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	464.79	515.88	570.12	611.8	577.45	433.74	294	307.47	433.81	470.37	448.5	444.37	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1149.03	1115.14	1014.24	857.8	664.04	449.12	296.01	311.26	483.31	724.75	957.99	1153.15	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	509.08	402.7	330.43	177.13	64.42	0	0	0	0	189.26	366.83	527.33	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 2567.17 (98)

Space heating requirement in kWh/m²/year 34.65 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2567.17	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	2021.65	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	673.88	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2063.8	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1625.24	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	541.75	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	48.63	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.94	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	47.94	(331)
Energy for lighting (calculated in Appendix L)		327.88	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	5320.13	x	0.22	1149.15	(363)

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less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1702.44	x	0.52		-883.57	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4276.95	x	0.22		923.82	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1368.62	x	0.52		-710.32	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	282.34	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	25.24	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	786.66	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					786.66	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	24.88	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	170.17	(379)
Total CO2, kg/year	sum of (376)…(382) =					981.71	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					13.25	(384)
EI rating (section 14)						88.95	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-2-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.09	(1a) x	2.4	(2a) =	177.82	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.09	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	177.82	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Floor			74.09	x	0.13	=	9.6317			(28)
Walls Type1	31	12.88	18.12	x	0.18	=	3.26			(29)
Walls Type2	31.26	2.1	29.16	x	0.18	=	5.25			(29)
Total area of elements, m²			136.35							(31)
Party wall			31.88	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.21 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 49.53 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	35.38	35.15	34.92	33.84	33.63	32.69	32.69	32.52	33.06	33.63	34.04	34.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	84.91	84.68	84.45	83.37	83.17	82.23	82.23	82.05	82.59	83.17	83.58	84	

Average = Sum(39)$_{1\ldots12}$ /12= 83.37 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.15	1.14	1.14	1.13	1.12	1.11	1.11	1.11	1.11	1.12	1.13	1.13	

Average = Sum(40)$_{1\ldots12}$ /12= 1.13 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.34 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.8 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	98.78	95.19	91.6	88.01	84.42	80.82	80.82	84.42	88.01	91.6	95.19	98.78	

Total = Sum(44)$_{1\ldots12}$ = 1077.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.49	128.12	132.21	115.27	110.6	95.44	88.44	101.49	102.7	119.68	130.64	141.87	

Total = Sum(45)$_{1\ldots12}$ = 1412.96 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.97	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.4	17.95	19.6	21.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	193.09	170.21	178.81	160.36	157.2	140.53	135.03	148.08	147.79	166.28	175.74	188.47	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	193.09	170.21	178.81	160.36	157.2	140.53	135.03	148.08	147.79	166.28	175.74	188.47

Output from water heater (annual)$_{1...12}$ | 1961.57 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.98	76.27	81.24	74.4	74.05	67.81	66.68	71.02	70.22	77.07	79.51	84.45	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.93	16.81	13.67	10.35	7.74	6.53	7.06	9.17	12.31	15.63	18.25	19.45	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	206.65	208.79	203.39	191.89	177.36	163.72	154.6	152.45	157.86	169.36	183.88	197.53	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	(71)

Water heating gains (Table 5)

(72)m=	115.57	113.5	109.19	103.33	99.53	94.18	89.63	95.46	97.53	103.59	110.43	113.51	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	402.26	400.22	387.37	366.69	345.75	325.54	312.4	318.2	328.82	349.7	373.68	391.61	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.6	x	10.63	x	0.63	x	0.7	=	14.95	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.63	x	0.7	=	28.57	(74)

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North	0.9x	0.77	x	4.6	x	34.53	x	0.63	x	0.7	=	48.54	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.63	x	0.7	=	77.97	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.63	x	0.7	=	105.04	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.63	x	0.7	=	112.44	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.63	x	0.7	=	104.98	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.63	x	0.7	=	83.29	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.63	x	0.7	=	58.36	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.63	x	0.7	=	34.01	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.63	x	0.7	=	18.44	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.63	x	0.7	=	12.46	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)

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East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	64.65	125.79	208.65	311.49	391.22	405.4	383.89	322.86	244.58	149.37	80.41	53.33	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	466.91	526.01	596.02	678.17	736.96	730.94	696.29	641.07	573.4	499.07	454.09	444.94	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.95	0.86	0.68	0.51	0.57	0.83	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.79	19.93	20.19	20.54	20.82	20.96	20.99	20.99	20.88	20.52	20.1	19.77	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.96	19.97	19.97	19.98	19.98	19.99	19.99	19.99	19.99	19.98	19.98	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.81	0.59	0.4	0.46	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.36	18.57	18.94	19.44	19.81	19.97	19.99	19.99	19.9	19.42	18.81	18.33	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.93	19.11	19.44	19.88	20.21	20.36	20.39	20.39	20.29	19.86	19.33	18.91	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.93	19.11	19.44	19.88	20.21	20.36	20.39	20.39	20.29	19.86	19.33	18.91	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.82	0.62	0.44	0.5	0.79	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	464.8	521.45	583.1	633.06	603.89	454.93	309	322.26	450.7	478.61	450.04	443.35	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1242.37	1203.54	1092.88	915.37	707.9	473.99	311.72	327.25	511.32	770.11	1021.79	1235.49	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	578.51	458.36	379.27	203.27	77.38	0	0	0	0	216.87	411.66	589.35	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 2914.67 (98)

Space heating requirement in kWh/m²/year 39.34 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system			0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =		1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =		1	(204)
Efficiency of main space heating system 1			93.5	(206)
Efficiency of secondary/supplementary heating system, %			0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	578.51	458.36	379.27	203.27	77.38	0	0	0	0	216.87	411.66	589.35		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	618.73	490.23	405.64	217.4	82.76	0	0	0	0	231.95	440.28	630.32		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3117.3	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	193.09	170.21	178.81	160.36	157.2	140.53	135.03	148.08	147.79	166.28	175.74	188.47		
Efficiency of water heater													79.8	(216)
(217)m=	87.56	87.33	86.77	85.45	83.04	79.8	79.8	79.8	79.8	85.52	87.01	87.65		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	220.52	194.91	206.07	187.67	189.3	176.1	169.22	185.56	185.2	194.42	201.97	215.02		
Total = Sum(219a)$_{1...12}$ =													2325.96	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3117.3	
Water heating fuel used			2325.96	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			334.23	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	673.34	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	502.41	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1175.74	(265)

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Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	173.47	(268)
Total CO2, kg/year			sum of (265)…(271) =		1388.14	(272)

TER = 18.74 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b2-2-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	75.18	(1a)	x	2.4	(2a)	=	180.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.18	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	180.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Floor			75.18	x	0.11	=	8.2698			(28)
Walls Type1	41.41	15.41	26	x	0.18	=	4.68			(29)
Walls Type2	4.86	2.1	2.76	x	0.18	=	0.5			(29)
Total area of elements, m²			121.45							(31)
Party wall			42	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.61 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 13.52 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 47.13 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	

Average = Sum(39)$_{1...12}$ /12= 76.9 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	

Average = Sum(40)$_{1...12}$ /12= 1.02 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.37 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.37 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	99.41	95.79	92.18	88.56	84.95	81.33	81.33	84.95	88.56	92.18	95.79	99.41	

Total = Sum(44)$_{1...12}$ = 1084.44 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.42	128.93	133.05	115.99	111.3	96.04	89	102.13	103.35	120.44	131.47	142.77	

Total = Sum(45)$_{1...12}$ = 1421.87 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.11	19.34	19.96	17.4	16.69	14.41	13.35	15.32	15.5	18.07	19.72	21.41	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3												0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.69	178.86	188.32	169.49	166.58	149.54	144.27	157.4	156.84	175.72	184.96	198.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.69	178.86	188.32	169.49	166.58	149.54	144.27	157.4	156.84	175.72	184.96	198.04	

Output from water heater (annual)$_{1...12}$ 2072.71 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.24	82.81	88.46	81.36	81.23	74.73	73.81	78.18	77.16	84.27	86.51	91.69	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.64	16.56	13.46	10.19	7.62	6.43	6.95	9.03	12.13	15.4	17.97	19.16	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	209.07	211.24	205.78	194.14	179.44	165.64	156.41	154.24	159.71	171.35	186.04	199.85	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	(71)

Water heating gains (Table 5)

(72)m=	125.32	123.23	118.9	113	109.18	103.79	99.21	105.08	107.16	113.26	120.15	123.24	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.51	409.51	396.61	375.81	354.72	334.33	321.05	326.83	337.47	358.48	382.64	400.72	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(76)
East	0.9x	1	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(76)

East	0.9x	1	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(76)
East	0.9x	1	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(76)
East	0.9x	1	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(76)
East	0.9x	1	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(76)
East	0.9x	1	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(76)
East	0.9x	1	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(76)
East	0.9x	1	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(76)
East	0.9x	1	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(76)
East	0.9x	1	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(76)
East	0.9x	1	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)

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South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	159.95	271.13	366.39	444.56	488.08	479.88	464.62	433.09	393.73	298.53	191.37	137.01	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	571.46	680.64	763	820.36	842.8	814.22	785.67	759.92	731.2	657.01	574.01	537.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.89	0.77	0.59	0.43	0.46	0.69	0.92	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.08	20.27	20.51	20.75	20.92	20.98	21	21	20.96	20.75	20.36	20.03	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.87	0.71	0.51	0.34	0.37	0.61	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.86	19.13	19.46	19.79	19.99	20.05	20.06	20.06	20.04	19.79	19.25	18.78	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.59	19.88	20.17	20.36	20.43	20.44	20.44	20.41	20.17	19.69	19.28	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.59	19.88	20.17	20.36	20.43	20.44	20.44	20.41	20.17	19.69	19.28	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.87	0.73	0.54	0.37	0.41	0.64	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	565.54	663.53	718.96	712.94	617.41	440.45	294.25	309.08	466.98	585.14	560.57	533.58	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1157.07	1129.28	1028.93	866.73	665.81	448.03	295.07	310.39	485.14	736.25	968.34	1159.73	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	440.1	312.98	230.61	110.73	36.01	0	0	0	0	112.43	293.59	465.85	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 2002.32 (98)

Space heating requirement in kWh/m²/year 26.63 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2002.32	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1576.82	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	525.61	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2072.71	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1632.26	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	544.09	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	42.79	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		48.65	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	48.65	(331)
Energy for lighting (calculated in Appendix L)		329.17	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		**Emission factor kg CO2/kWh**	**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4149.54	x	0.22	896.3	(363)

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less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1327.85	x	0.52		-689.15	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4295.42	x	0.22		927.81	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1374.54	x	0.52		-713.38	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	248.45	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	22.21	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	692.22	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					692.22	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	25.25	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	170.84	(379)
Total CO2, kg/year	sum of (376)…(382) =					888.31	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					11.82	(384)
EI rating (section 14)						90.1	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-2-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	75.18	(1a) x	2.4	(2a) =	180.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.18	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	180.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Floor			75.18	x	0.13	=	9.773399			(28)
Walls Type1	41.41	15.41	26	x	0.18	=	4.68			(29)
Walls Type2	4.86	2.1	2.76	x	0.18	=	0.5			(29)
Total area of elements, m²			121.45							(31)
Party wall			42	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.48 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.45 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 47.93 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	35.83	35.6	35.36	34.28	34.08	33.14	33.14	32.96	33.5	34.08	34.49	34.92	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	83.76	83.53	83.3	82.22	82.01	81.07	81.07	80.89	81.43	82.01	82.42	82.85	

Average = Sum(39)$_{1...12}$ /12= 82.21 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.11	1.11	1.11	1.09	1.09	1.08	1.08	1.08	1.08	1.09	1.1	1.1	

Average = Sum(40)$_{1...12}$ /12= 1.09 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.37 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.37 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	99.41	95.79	92.18	88.56	84.95	81.33	81.33	84.95	88.56	92.18	95.79	99.41	

Total = Sum(44)$_{1...12}$ = 1084.44 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.42	128.93	133.05	115.99	111.3	96.04	89	102.13	103.35	120.44	131.47	142.77	

Total = Sum(45)$_{1...12}$ = 1421.87 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.11	19.34	19.96	17.4	16.69	14.41	13.35	15.32	15.5	18.07	19.72	21.41	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	194.01	171.02	179.64	161.09	157.89	141.13	135.59	148.72	148.44	167.03	176.56	189.36	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	194.01	171.02	179.64	161.09	157.89	141.13	135.59	148.72	148.44	167.03	176.56	189.36	

Output from water heater (annual)$_{1…12}$	1970.49	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.29	76.54	81.51	74.64	74.28	68.01	66.87	71.23	70.44	77.32	79.79	84.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.73	16.63	13.53	10.24	7.65	6.46	6.98	9.08	12.18	15.47	18.05	19.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	209.07	211.24	205.78	194.14	179.44	165.64	156.41	154.24	159.71	171.35	186.04	199.85	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	(71)

Water heating gains (Table 5)

(72)m=	115.98	113.9	109.56	103.67	99.84	94.45	89.88	95.74	97.83	103.93	110.81	113.91	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	405.26	403.25	390.34	369.52	348.42	328.03	314.75	320.54	331.2	352.22	376.39	394.48	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.29	x	19.64	x	0.63	x	0.7	=	31.75	(76)
East	0.9x	1	x	5.29	x	38.42	x	0.63	x	0.7	=	62.11	(76)

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East	0.9x	1	x	5.29	x	63.27	x	0.63	x	0.7	=	102.29	(76)
East	0.9x	1	x	5.29	x	92.28	x	0.63	x	0.7	=	149.19	(76)
East	0.9x	1	x	5.29	x	113.09	x	0.63	x	0.7	=	182.84	(76)
East	0.9x	1	x	5.29	x	115.77	x	0.63	x	0.7	=	187.17	(76)
East	0.9x	1	x	5.29	x	110.22	x	0.63	x	0.7	=	178.19	(76)
East	0.9x	1	x	5.29	x	94.68	x	0.63	x	0.7	=	153.06	(76)
East	0.9x	1	x	5.29	x	73.59	x	0.63	x	0.7	=	118.97	(76)
East	0.9x	1	x	5.29	x	45.59	x	0.63	x	0.7	=	73.7	(76)
East	0.9x	1	x	5.29	x	24.49	x	0.63	x	0.7	=	39.59	(76)
East	0.9x	1	x	5.29	x	16.15	x	0.63	x	0.7	=	26.11	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.63	x	0.7	=	65.72	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.63	x	0.7	=	107.64	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.63	x	0.7	=	137.12	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.63	x	0.7	=	154.97	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.63	x	0.7	=	161.49	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.63	x	0.7	=	155.41	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.63	x	0.7	=	151.85	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.63	x	0.7	=	147.46	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.63	x	0.7	=	143.23	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.63	x	0.7	=	116.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)

South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.63	x	0.7	=	77.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.63	x	0.7	=	56.79	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	176.35	298.92	403.95	490.12	538.11	529.07	512.25	477.48	434.08	329.12	210.99	151.05	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	581.61	702.17	794.29	859.64	886.53	857.1	826.99	798.02	765.28	681.34	587.37	545.53	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.89	0.77	0.59	0.43	0.46	0.69	0.92	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.18	20.44	20.71	20.9	20.98	21	21	20.96	20.71	20.28	19.93	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.99	19.99	19.99	20.01	20.01	20.02	20.02	20.02	20.01	20.01	20	20	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.86	0.71	0.51	0.33	0.37	0.61	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.63	18.93	19.31	19.69	19.92	20.01	20.02	20.02	19.98	19.7	19.1	18.58	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.17	19.43	19.76	20.1	20.31	20.4	20.41	20.41	20.37	20.1	19.57	19.12	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.17	19.43	19.76	20.1	20.31	20.4	20.41	20.41	20.37	20.1	19.57	19.12	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.87	0.73	0.54	0.37	0.4	0.64	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	575.43	684.05	747.75	745.3	648.68	460.9	307.76	322.71	488.96	606.82	573.42	541.18	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1245.22	1213.77	1104.4	920.83	706.15	469.92	308.82	324.34	510.84	779.49	1028.2	1236.33	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	498.32	355.97	265.35	126.38	42.76	0	0	0	0	128.47	327.44	517.2	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2261.89 (98)

Space heating requirement in kWh/m²/year 30.09 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	498.32	355.97	265.35	126.38	42.76	0	0	0	0	128.47	327.44	517.2		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	532.97	380.72	283.79	135.17	45.73	0	0	0	0	137.4	350.2	553.15		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2419.13	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	194.01	171.02	179.64	161.09	157.89	141.13	135.59	148.72	148.44	167.03	176.56	189.36		
Efficiency of water heater													79.8	(216)
(217)m=	87.22	86.73	85.85	84.18	81.86	79.8	79.8	79.8	79.8	84.12	86.44	87.36		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	222.43	197.19	209.24	191.37	192.88	176.86	169.91	186.37	186.01	198.56	204.26	216.76		
Total = Sum(219a)$_{1...12}$ =													2351.84	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2419.13	
Water heating fuel used			2351.84	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			330.71	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	522.53	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	508	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1030.53	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	171.64	(268)
Total CO2, kg/year		sum of (265)…(271) =		1241.09	(272)

TER =	16.51	(273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-2-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	76.86	(1a) x	2.4	(2a) =	184.46	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76.86	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.46	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			6.9	x1/[1/(1.2)+ 0.04]		=	7.9			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Floor			76.86	x	0.11	=	8.4546			(28)
Walls Type1	31.77	14.26	17.51	x	0.18	=	3.15			(29)
Walls Type2	23.59	2.1	21.49	x	0.18	=	3.87			(29)
Total area of elements, m²			132.22							(31)
Party wall			33.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	34.32	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		13.36	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	47.68	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.12	78.12	78.12	78.12	78.12	78.12	78.12	78.12	78.12	78.12	78.12	78.12	

Average = $Sum(39)_{1...12}$ /12= 78.12 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	

Average = $Sum(40)_{1...12}$ /12= 1.02 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.4 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.21 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	100.34	96.69	93.04	89.39	85.74	82.09	82.09	85.74	89.39	93.04	96.69	100.34

Total = $Sum(44)_{1...12}$ = 1094.57 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	148.79	130.14	134.29	117.08	112.34	96.94	89.83	103.08	104.31	121.56	132.7	144.1

Total = $Sum(45)_{1...12}$ = 1435.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.32	19.52	20.14	17.56	16.85	14.54	13.47	15.46	15.65	18.23	19.9	21.61	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	204.07	180.06	189.57	170.57	167.61	150.43	145.1	158.36	157.8	176.84	186.19	199.38	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	204.07	180.06	189.57	170.57	167.61	150.43	145.1	158.36	157.8	176.84	186.19	199.38

Output from water heater (annual)$_{1...12}$	2085.99	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.7	83.21	88.87	81.72	81.57	75.03	74.09	78.5	77.48	84.64	86.92	92.13	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.01	16.88	13.73	10.39	7.77	6.56	7.09	9.21	12.37	15.7	18.33	19.54	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	212.75	214.96	209.4	197.55	182.6	168.55	159.16	156.96	162.52	174.36	189.31	203.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35	35	35	35	35	35	35	35	35	35	35	35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	(71)

Water heating gains (Table 5)

(72)m=	125.93	123.83	119.45	113.5	109.64	104.2	99.58	105.5	107.61	113.77	120.72	123.84	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	416.7	414.68	401.59	380.46	359.02	338.32	324.84	330.68	341.5	362.84	387.37	405.75	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	6.9	x	46.75	x	0.5	x	0.8	=	89.42	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)

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South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	6.9	x	76.57	x	0.5	x	0.8	=	146.45	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	6.9	x	97.53	x	0.5	x	0.8	=	186.55	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	6.9	x	110.23	x	0.5	x	0.8	=	210.84	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	6.9	x	114.87	x	0.5	x	0.8	=	219.71	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	6.9	x	110.55	x	0.5	x	0.8	=	211.44	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	6.9	x	108.01	x	0.5	x	0.8	=	206.59	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	6.9	x	104.89	x	0.5	x	0.8	=	200.63	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	6.9	x	101.89	x	0.5	x	0.8	=	194.87	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	6.9	x	82.59	x	0.5	x	0.8	=	157.96	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	6.9	x	55.42	x	0.5	x	0.8	=	106	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	6.9	x	40.4	x	0.5	x	0.8	=	77.27	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)

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West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	164.06	273.48	359.33	422.01	452.71	440.98	428.65	406.82	381.09	298.15	195.39	141.14	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	580.77	688.16	760.91	802.47	811.73	779.3	753.49	737.5	722.59	660.98	582.76	546.88	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.91	0.8	0.62	0.45	0.48	0.7	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.27	20.5	20.73	20.9	20.98	21	21	20.96	20.74	20.36	20.04	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.88	0.74	0.54	0.36	0.39	0.62	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.87	19.13	19.45	19.77	19.98	20.06	20.07	20.07	20.04	19.79	19.26	18.79	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.36	19.59	19.87	20.15	20.35	20.43	20.44	20.44	20.41	20.17	19.7	19.29	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.36	19.59	19.87	20.15	20.35	20.43	20.44	20.44	20.41	20.17	19.7	19.29	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.88	0.76	0.57	0.4	0.43	0.65	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	574.87	671.48	720.25	708.73	617.1	445.28	298.88	313.9	472.49	591.3	569.39	542.74	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1176.1	1147.4	1044.37	878.86	675.43	455.12	299.97	315.52	492.85	747.85	984.19	1178.87	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	447.31	319.82	241.15	122.49	43.4	0	0	0	0	116.48	298.65	473.28	

Total per year (kWh/year) = $\text{Sum}(98)_{1\ldots5,9\ldots12}$ = | 2062.58 | (98)

Space heating requirement in kWh/m²/year | 26.84 | (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2062.58	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1624.28	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	541.43	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2085.99	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1642.72	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	547.57	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.56	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		49.74	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	49.74	(331)
Energy for lighting (calculated in Appendix L)		335.67	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4274.42	x	0.22	923.27	(363)

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less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1367.81	x	0.52		-709.9	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4322.94	x	0.22		933.75	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1383.34	x	0.52		-717.95	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	252.93	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	22.61	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	704.72	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					704.72	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	25.81	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	174.21	(379)
Total CO2, kg/year	sum of (376)…(382) =					904.74	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					11.77	(384)
EI rating (section 14)						90.05	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-2-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	76.86	(1a) x	2.4	(2a) =	184.46	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76.86	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.46	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.16	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.41	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.32	0.35	0.38	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			6.9	x1/[1/(1.4)+ 0.04]		=	9.15			(27)
Windows Type 2			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Floor			76.86	x	0.13	=	9.991799			(28)
Walls Type1	31.77	14.26	17.51	x	0.18	=	3.15			(29)
Walls Type2	23.59	2.1	21.49	x	0.18	=	3.87			(29)
Total area of elements, m²			132.22							(31)
Party wall			33.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.02 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.46 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 49.47 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	36.52	36.29	36.06	34.97	34.76	33.82	33.82	33.64	34.18	34.76	35.18	35.61	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	86	85.76	85.53	84.44	84.24	83.29	83.29	83.11	83.66	84.24	84.65	85.08	

Average = Sum(39)$_{1...12}$ /12= 84.44 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.12	1.12	1.11	1.1	1.1	1.08	1.08	1.08	1.09	1.1	1.1	1.11	

Average = Sum(40)$_{1...12}$ /12= 1.1 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.4 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.21 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	100.34	96.69	93.04	89.39	85.74	82.09	82.09	85.74	89.39	93.04	96.69	100.34	

Total = Sum(44)$_{1...12}$ = 1094.57 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	148.79	130.14	134.29	117.08	112.34	96.94	89.83	103.08	104.31	121.56	132.7	144.1	

Total = Sum(45)$_{1...12}$ = 1435.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.32	19.52	20.14	17.56	16.85	14.54	13.47	15.46	15.65	18.23	19.9	21.61	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	195.39	172.22	180.88	162.17	158.93	142.03	136.42	149.67	149.4	168.16	177.79	190.69	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	195.39	172.22	180.88	162.17	158.93	142.03	136.42	149.67	149.4	168.16	177.79	190.69

Output from water heater (annual)$_{1...12}$ | 1983.77 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.75	76.94	81.93	75	74.63	68.31	67.14	71.55	70.76	77.7	80.19	85.19	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.28	17.13	13.93	10.54	7.88	6.65	7.19	9.35	12.54	15.93	18.59	19.82	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	212.75	214.96	209.4	197.55	182.6	168.55	159.16	156.96	162.52	174.36	189.31	203.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35	35	35	35	35	35	35	35	35	35	35	35	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	(71)

Water heating gains (Table 5)

(72)m=	116.6	114.49	110.12	104.17	100.31	94.87	90.25	96.17	98.27	104.43	111.38	114.5	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	410.64	408.59	395.45	374.28	352.8	332.08	318.61	324.48	335.35	356.73	381.3	399.69	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	6.9	x	46.75	x	0.63	x	0.7	=	98.59	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.63	x	0.7	=	26.29	(78)

South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	6.9	x	76.57	x	0.63	x	0.7	=	161.46	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.63	x	0.7	=	43.06	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	6.9	x	97.53	x	0.63	x	0.7	=	205.67	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.63	x	0.7	=	54.85	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	6.9	x	110.23	x	0.63	x	0.7	=	232.45	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.63	x	0.7	=	61.99	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	6.9	x	114.87	x	0.63	x	0.7	=	242.23	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.63	x	0.7	=	64.6	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	6.9	x	110.55	x	0.63	x	0.7	=	233.12	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.63	x	0.7	=	62.16	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	6.9	x	108.01	x	0.63	x	0.7	=	227.77	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.63	x	0.7	=	60.74	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	6.9	x	104.89	x	0.63	x	0.7	=	221.19	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.63	x	0.7	=	58.99	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	6.9	x	101.89	x	0.63	x	0.7	=	214.85	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.63	x	0.7	=	57.29	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	6.9	x	82.59	x	0.63	x	0.7	=	174.15	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.63	x	0.7	=	46.44	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	6.9	x	55.42	x	0.63	x	0.7	=	116.86	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.63	x	0.7	=	31.16	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	6.9	x	40.4	x	0.63	x	0.7	=	85.19	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.63	x	0.7	=	22.72	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)

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West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	180.88	301.51	396.16	465.26	499.11	486.18	472.58	448.52	420.15	328.71	215.42	155.6	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	591.52	710.1	791.61	839.54	851.91	818.26	791.19	773	755.5	685.44	596.72	555.3	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.91	0.8	0.63	0.46	0.49	0.71	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.96	20.16	20.41	20.68	20.88	20.97	21	20.99	20.95	20.7	20.27	19.92	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.99	19.99	19.99	20	20	20.01	20.01	20.02	20.01	20	20	20	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.88	0.75	0.54	0.36	0.39	0.63	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.61	18.91	19.27	19.65	19.89	20	20.01	20.01	19.97	19.68	19.08	18.57	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.15	19.41	19.72	20.06	20.28	20.39	20.41	20.41	20.36	20.09	19.56	19.11	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.15	19.41	19.72	20.06	20.28	20.39	20.41	20.41	20.36	20.09	19.56	19.11	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.88	0.76	0.57	0.4	0.43	0.66	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	585.38	692.57	749.23	741.62	650.52	469.48	315.46	330.72	497.91	614.36	582.94	550.95	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1277.16	1244.42	1131.08	942.34	723.14	482.12	316.99	332.95	524.06	799.19	1054.74	1268.39	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	514.68	370.84	284.09	144.52	54.03	0	0	0	0	137.51	339.69	533.77	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = | 2379.14 | (98)

Space heating requirement in kWh/m²/year | 30.95 | (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	514.68	370.84	284.09	144.52	54.03	0	0	0	0	137.51	339.69	533.77		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	550.46	396.62	303.84	154.56	57.78	0	0	0	0	147.07	363.31	570.88		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2544.53	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	195.39	172.22	180.88	162.17	158.93	142.03	136.42	149.67	149.4	168.16	177.79	190.69		
Efficiency of water heater													79.8	(216)
(217)m=	87.28	86.81	86.01	84.51	82.27	79.8	79.8	79.8	79.8	84.28	86.51	87.41		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	223.87	198.39	210.3	191.9	193.19	177.98	170.96	187.56	187.22	199.52	205.5	218.15		
Total = Sum(219a)$_{1...12}$ =													2364.53	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2544.53	
Water heating fuel used			2364.53	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			340.54	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	549.62	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	510.74	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1060.36	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	176.74	(268)
Total CO2, kg/year		sum of (265)…(271) =		1276.02	(272)

TER =	16.6	(273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-2-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.72	(1a) x	2.4	(2a) =	176.93	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.72	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.93	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Floor			73.72	x	0.11	=	8.1092			(28)
Walls Type1	41.25	15.64	25.61	x	0.18	=	4.61			(29)
Walls Type2	32.91	2.1	30.81	x	0.18	=	5.55			(29)
Total area of elements, m²			147.88							(31)
Party wall			15.07	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.69 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 13.83 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 52.52 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	81.71	81.71	81.71	81.71	81.71	81.71	81.71	81.71	81.71	81.71	81.71	81.71	

Average = Sum(39)$_{1…12}$ /12= 81.71 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	

Average = Sum(40)$_{1…12}$ /12= 1.11 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.61 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	98.57	94.98	91.4	87.82	84.23	80.65	80.65	84.23	87.82	91.4	94.98	98.57	

Total = Sum(44)$_{1…12}$ = 1075.29 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.17	127.84	131.92	115.01	110.36	95.23	88.25	101.26	102.47	119.42	130.36	141.56	

Total = Sum(45)$_{1…12}$ = 1409.88 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.93	19.18	19.79	17.25	16.55	14.28	13.24	15.19	15.37	17.91	19.55	21.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.45	177.77	187.2	168.51	165.64	148.73	143.52	156.54	155.97	174.7	183.85	196.84	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.45	177.77	187.2	168.51	165.64	148.73	143.52	156.54	155.97	174.7	183.85	196.84

Output from water heater (annual)$_{1...12}$ — 2060.72 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.82	82.45	88.09	81.04	80.92	74.46	73.56	77.89	76.87	83.93	86.14	91.29	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.35	16.3	13.25	10.03	7.5	6.33	6.84	8.89	11.94	15.16	17.69	18.86	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.82	207.95	202.57	191.12	176.65	163.06	153.98	151.84	157.22	168.68	183.14	196.74	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	(71)

Water heating gains (Table 5)

(72)m=	124.76	122.69	118.4	112.55	108.76	103.42	98.88	104.69	106.76	112.81	119.64	122.7	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	406.93	404.94	392.22	371.7	350.9	330.8	317.69	323.42	333.91	354.64	378.47	396.29	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)

West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	161.2	273.58	370.43	450.44	495.29	487.26	471.65	439.12	398.42	301.43	192.93	138.04	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	568.13	678.52	762.64	822.13	846.2	818.06	789.34	762.55	732.33	656.07	571.4	534.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.79	0.61	0.45	0.49	0.71	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.17	20.42	20.69	20.88	20.97	21	20.99	20.95	20.69	20.26	19.92	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.88	0.73	0.53	0.35	0.38	0.63	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.64	18.92	19.28	19.64	19.89	19.98	19.99	19.99	19.96	19.66	19.07	18.57	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.17	19.42	19.74	20.06	20.28	20.38	20.39	20.39	20.35	20.07	19.55	19.11	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

DER WorkSheet: New dwelling design stage

(93)m=	19.17	19.42	19.74	20.06	20.28	20.38	20.39	20.39	20.35	20.07	19.55	19.11	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.88	0.75	0.56	0.39	0.42	0.66	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	562.17	661.91	720.98	722.04	635.26	460.04	308.51	323.92	484.02	589.61	558.37	530.1	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1215.45	1186.63	1081.64	911.97	701.49	472.03	310	326.23	510.87	773.75	1016.98	1218.17	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	486.04	352.61	268.33	136.75	49.28	0	0	0	0	137	330.2	511.93	

Total per year (kWh/year) = Sum(98)1...5,9...12 =	2272.12	(98)
Space heating requirement in kWh/m²/year	30.82	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2272.12	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1789.3	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	596.43	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2060.72	
If DHW from community scheme:			
Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1622.81	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	540.94	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	45.49	(313)

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Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.7	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	47.7	(331)
Energy for lighting (calculated in Appendix L)		324.05	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4708.68	x	0.22		1017.07	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1506.78	x	0.52		-782.02	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4270.56	x	0.22		922.44	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1366.58	x	0.52		-709.25	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	264.16	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	23.61	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	736.02	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					736.02	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	24.76	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	168.18	(379)
Total CO2, kg/year	sum of (376)…(382) =					928.96	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					12.6	(384)
EI rating (section 14)						89.51	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-2-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.72	(1a) x	2.4	(2a) =	176.93	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.72	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.93	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.45	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 5			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Floor			73.72	x	0.13	=	9.5836			(28)
Walls Type1	41.25	15.64	25.61	x	0.18	=	4.61			(29)
Walls Type2	32.91	2.1	30.81	x	0.18	=	5.55			(29)
Total area of elements, m²			147.88							(31)
Party wall			15.07	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	42.57	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		13.09	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	55.66	(37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.23	34.99	34.76	33.69	33.48	32.54	32.54	32.37	32.91	33.48	33.89	34.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	90.89	90.66	90.43	89.35	89.15	88.21	88.21	88.03	88.57	89.15	89.56	89.98	

Average = Sum(39)$_{1...12}$ /12= 89.35 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.23	1.23	1.23	1.21	1.21	1.2	1.2	1.19	1.2	1.21	1.21	1.22

Average = Sum(40)$_{1...12}$ /12= 1.21 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.61 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	98.57	94.98	91.4	87.82	84.23	80.65	80.65	84.23	87.82	91.4	94.98	98.57

Total = Sum(44)$_{1...12}$ = 1075.29 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.17	127.84	131.92	115.01	110.36	95.23	88.25	101.26	102.47	119.42	130.36	141.56

Total = Sum(45)$_{1...12}$ = 1409.88 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.93	19.18	19.79	17.25	16.55	14.28	13.24	15.19	15.37	17.91	19.55	21.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	192.77	169.93	178.52	160.11	156.95	140.32	134.84	147.86	147.57	166.02	175.45	188.16	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	192.77	169.93	178.52	160.11	156.95	140.32	134.84	147.86	147.57	166.02	175.45	188.16

Output from water heater (annual)$_{1\ldots12}$ | 1958.49 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.88	76.18	81.14	74.32	73.97	67.74	66.62	70.95	70.15	76.98	79.42	84.35	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.39	16.33	13.28	10.05	7.52	6.35	6.86	8.91	11.96	15.19	17.73	18.9	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.82	207.95	202.57	191.12	176.65	163.06	153.98	151.84	157.22	168.68	183.14	196.74	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	(71)

Water heating gains (Table 5)

(72)m=	115.43	113.36	109.06	103.22	99.42	94.08	89.54	95.36	97.42	103.47	110.3	113.37	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	400.63	398.64	385.91	365.38	344.58	324.48	311.37	317.11	327.6	348.34	372.17	390	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.63	x	0.7	=	65.72	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.63	x	0.7	=	107.64	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.63	x	0.7	=	137.12	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.63	x	0.7	=	154.97	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.63	x	0.7	=	161.49	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.63	x	0.7	=	155.41	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.63	x	0.7	=	151.85	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.63	x	0.7	=	147.46	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.63	x	0.7	=	143.23	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.63	x	0.7	=	116.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.63	x	0.7	=	77.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.63	x	0.7	=	56.79	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)

West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	177.73	301.62	408.39	496.61	546.06	537.21	520	484.13	439.26	332.33	212.71	152.19	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	578.36	700.26	794.3	861.99	890.64	861.68	831.36	801.24	766.86	680.67	584.88	542.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.91	0.8	0.62	0.46	0.5	0.72	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.82	20.03	20.31	20.62	20.85	20.97	20.99	20.99	20.93	20.63	20.16	19.78	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.89	19.9	19.9	19.91	19.91	19.92	19.92	19.92	19.92	19.91	19.91	19.9	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.88	0.74	0.53	0.35	0.38	0.64	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.34	18.66	19.06	19.49	19.78	19.9	19.92	19.92	19.87	19.51	18.85	18.29	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.93	19.21	19.56	19.94	20.21	20.33	20.35	20.35	20.29	19.96	19.37	18.89	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.93	19.21	19.56	19.94	20.21	20.33	20.35	20.35	20.29	19.96	19.37	18.89	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.97	0.95	0.88	0.76	0.57	0.4	0.43	0.67	0.9	0.98	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	572.07	682.67	750.74	757.7	673.09	488.96	328.51	344.27	512.76	613.09	571.38	537.69		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	1329.94	1297.04	1180.94	986.79	758.23	505.19	330.76	347.65	548.49	834.17	1099.18	1321.55		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	563.86	412.86	320.07	164.95	63.35	0	0	0	0	164.48	380.01	583.19		
Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =													2652.76	(98)
Space heating requirement in kWh/m²/year													35.98	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	563.86	412.86	320.07	164.95	63.35	0	0	0	0	164.48	380.01	583.19		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	603.06	441.56	342.32	176.42	67.75	0	0	0	0	175.92	406.43	623.73		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2837.18	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	192.77	169.93	178.52	160.11	156.95	140.32	134.84	147.86	147.57	166.02	175.45	188.16		
Efficiency of water heater													79.8	(216)
(217)m=	87.51	87.09	86.35	84.89	82.61	79.8	79.8	79.8	79.8	84.79	86.82	87.63		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	220.28	195.11	206.73	188.6	190	175.84	168.97	185.29	184.92	195.8	202.08	214.71		
Total = Sum(219a)$_{1...12}$ =													2328.33	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2837.18

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Water heating fuel used			2328.33	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			324.72	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	612.83	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	502.92	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1115.75	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	168.53	(268)
Total CO2, kg/year			sum of (265)…(271) =		1323.2	(272)

TER =	17.95	(273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-2-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.77	(1a) x	2.4	(2a) =	169.85	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.77	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	169.85	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 4			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Floor			70.77	x	0.11	=	7.784699			(28)
Walls Type1	35.57	16.33	19.24	x	0.18	=	3.46			(29)
Walls Type2	47.73	2.1	45.63	x	0.18	=	8.21			(29)
Total area of elements, m²			154.07							(31)
Party wall			15.1	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	40.68	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		15.88	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	56.56	(37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.02	28.02	28.02	28.02	28.02	28.02	28.02	28.02	28.02	28.02	28.02	28.02	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	84.59	84.59	84.59	84.59	84.59	84.59	84.59	84.59	84.59	84.59	84.59	84.59	

Average = Sum(39)$_{1…12}$ /12= 84.59 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	

Average = Sum(40)$_{1…12}$ /12= 1.2 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.26 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.99 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.78	93.27	89.75	86.23	82.71	79.19	79.19	82.71	86.23	89.75	93.27	96.78	

Total = Sum(44)$_{1…12}$ = 1055.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.53	125.53	129.54	112.93	108.36	93.51	86.65	99.43	100.62	117.26	128	139	

Total = Sum(45)$_{1…12}$ = 1384.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.53	18.83	19.43	16.94	16.25	14.03	13	14.91	15.09	17.59	19.2	20.85	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	198.81	175.46	184.81	166.43	163.64	147	141.93	154.71	154.11	172.54	181.49	194.28	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	198.81	175.46	184.81	166.43	163.64	147	141.93	154.71	154.11	172.54	181.49	194.28

Output from water heater (annual)$_{1…12}$ — 2035.2 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.94	81.68	87.29	80.35	80.25	73.89	73.03	77.28	76.25	83.21	85.36	90.44	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.75	15.76	12.82	9.71	7.26	6.13	6.62	8.6	11.55	14.66	17.11	18.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.09	201.15	195.95	184.86	170.87	157.73	148.94	146.88	152.08	163.16	177.15	190.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	(71)

Water heating gains (Table 5)

(72)m=	123.58	121.55	117.33	111.59	107.87	102.62	98.16	103.87	105.9	111.84	118.55	121.56	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	397.39	395.44	383.07	363.13	342.96	323.44	310.69	316.32	326.5	346.64	369.79	387.07	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	4.6	x	10.63	x	0.5	x	0.8	=	13.56	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.5	x	0.8	=	25.91	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	4.6	x	34.53	x	0.5	x	0.8	=	44.03	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.5	x	0.8	=	70.72	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.5	x	0.8	=	95.27	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.5	x	0.8	=	101.99	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.5	x	0.8	=	95.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.5	x	0.8	=	75.55	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.5	x	0.8	=	52.94	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.5	x	0.8	=	30.84	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.5	x	0.8	=	16.73	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.5	x	0.8	=	11.3	(74)
West	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(80)

West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.23	132.37	220.45	333.22	423.85	441.92	417.35	347.25	259.5	157.25	84.75	56.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	465.62	527.81	603.51	696.35	766.82	765.36	728.04	663.57	586	503.89	454.54	443.46	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.84	0.66	0.5	0.57	0.83	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.75	19.9	20.17	20.52	20.81	20.96	20.99	20.98	20.87	20.49	20.05	19.71	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.79	0.57	0.38	0.44	0.75	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.27	18.48	18.87	19.37	19.75	19.9	19.92	19.92	19.82	19.33	18.7	18.21	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.86	19.05	19.39	19.83	20.17	20.32	20.35	20.34	20.24	19.79	19.24	18.81	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.86	19.05	19.39	19.83	20.17	20.32	20.35	20.34	20.24	19.79	19.24	18.81	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.92	0.8	0.61	0.43	0.49	0.78	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	463.08	522.31	587.94	643.08	613.85	463.39	313.95	327.68	454.86	480.67	449.73	441.53	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1231.82	1196.83	1090.36	924.45	716.68	483.8	317.09	333.6	519.49	777.66	1026.87	1235.98	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	571.94	453.28	373.8	202.59	76.5	0	0	0	0	220.96	415.54	591.07	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2905.67 (98)

Space heating requirement in kWh/m²/year 41.06 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2905.67	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	2288.22	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	762.74	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2035.2	
If DHW from community scheme:			
Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1602.72	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	534.24	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	51.88	(313)

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Cooling System Energy Efficiency Ratio					0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =				0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside					45.79	(330a)
warm air heating system fans					0	(330b)
pump for solar water heating					0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =				45.79	(331)
Energy for lighting (calculated in Appendix L)					313.45	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit					32	(361)
Heat efficiency of CHP unit					38	(362)
		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	6021.62	x	0.22	1300.67	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1926.92	x	0.52	-1000.07	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4217.69	x	0.22	911.02	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1349.66	x	0.52	-700.47	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	= 301.23	(368)
Electrical energy for heat distribution	[(313) x			0.52	= 26.93	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				= 839.31	(373)
CO2 associated with space heating (secondary)	(309) x			0	= 0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	= 0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				839.31	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	= 23.77	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	= 162.68	(379)
Total CO2, kg/year	sum of (376)…(382) =				1025.75	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.49	(384)
EI rating (section 14)					88.13	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-2-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.77	(1a) x	2.4	(2a) =	169.85	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.77	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		169.85	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.43	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.34	0.36	0.39	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.76	x1/[1/(1.4)+ 0.04]		=	2.33			(27)
Windows Type 2			1.76	x1/[1/(1.4)+ 0.04]		=	2.33			(27)
Windows Type 3			4.39	x1/[1/(1.4)+ 0.04]		=	5.82			(27)
Windows Type 4			5.05	x1/[1/(1.4)+ 0.04]		=	6.7			(27)
Windows Type 5			2.64	x1/[1/(1.4)+ 0.04]		=	3.5			(27)
Floor			70.77	x	0.13	=	9.200099			(28)
Walls Type1	35.57	15.6	19.97	x	0.18	=	3.59			(29)
Walls Type2	47.73	2.1	45.63	x	0.18	=	8.21			(29)
Total area of elements, m²			154.07							(31)
Party wall			15.1	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 43.79 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.84 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 58.63 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.02	33.78	33.56	32.48	32.28	31.35	31.35	31.18	31.71	32.28	32.69	33.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	92.65	92.42	92.19	91.12	90.92	89.99	89.99	89.81	90.34	90.92	91.32	91.75	

Average = Sum(39)$_{1…12}$ /12= 91.12 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.31	1.31	1.3	1.29	1.28	1.27	1.27	1.27	1.28	1.28	1.29	1.3	

Average = Sum(40)$_{1…12}$ /12= 1.29 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.26 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.99 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	96.78	93.27	89.75	86.23	82.71	79.19	79.19	82.71	86.23	89.75	93.27	96.78	

Total = Sum(44)$_{1…12}$ = 1055.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.53	125.53	129.54	112.93	108.36	93.51	86.65	99.43	100.62	117.26	128	139	

Total = Sum(45)$_{1…12}$ = 1384.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.53	18.83	19.43	16.94	16.25	14.03	13	14.91	15.09	17.59	19.2	20.85	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	190.12	167.62	176.13	158.03	154.96	138.6	133.24	146.03	145.71	163.86	173.09	185.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	190.12	167.62	176.13	158.03	154.96	138.6	133.24	146.03	145.71	163.86	173.09	185.59

Output from water heater (annual)$_{1...12}$ | 1932.98 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85	75.41	80.35	73.62	73.31	67.17	66.09	70.34	69.53	76.27	78.63	83.49	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.75	15.77	12.82	9.71	7.26	6.13	6.62	8.61	11.55	14.67	17.12	18.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.09	201.15	195.95	184.86	170.87	157.73	148.94	146.88	152.08	163.16	177.15	190.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	(71)

Water heating gains (Table 5)

(72)m=	114.25	112.21	107.99	102.26	98.53	93.28	88.83	94.54	96.57	102.51	109.21	112.22	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	391.06	389.11	376.73	356.8	336.63	317.11	304.36	309.99	320.17	340.31	363.45	380.74	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	1.76	x	10.63	x	0.63	x	0.7	=	5.72	(74)
North	0.9x	0.77	x	1.76	x	10.63	x	0.63	x	0.7	=	5.72	(74)
North	0.9x	0.77	x	4.39	x	10.63	x	0.63	x	0.7	=	14.27	(74)
North	0.9x	0.77	x	1.76	x	20.32	x	0.63	x	0.7	=	10.93	(74)
North	0.9x	0.77	x	1.76	x	20.32	x	0.63	x	0.7	=	10.93	(74)
North	0.9x	0.77	x	4.39	x	20.32	x	0.63	x	0.7	=	27.26	(74)
North	0.9x	0.77	x	1.76	x	34.53	x	0.63	x	0.7	=	18.57	(74)
North	0.9x	0.77	x	1.76	x	34.53	x	0.63	x	0.7	=	18.57	(74)
North	0.9x	0.77	x	4.39	x	34.53	x	0.63	x	0.7	=	46.33	(74)
North	0.9x	0.77	x	1.76	x	55.46	x	0.63	x	0.7	=	29.83	(74)
North	0.9x	0.77	x	1.76	x	55.46	x	0.63	x	0.7	=	29.83	(74)
North	0.9x	0.77	x	4.39	x	55.46	x	0.63	x	0.7	=	74.41	(74)
North	0.9x	0.77	x	1.76	x	74.72	x	0.63	x	0.7	=	40.19	(74)
North	0.9x	0.77	x	1.76	x	74.72	x	0.63	x	0.7	=	40.19	(74)
North	0.9x	0.77	x	4.39	x	74.72	x	0.63	x	0.7	=	100.24	(74)
North	0.9x	0.77	x	1.76	x	79.99	x	0.63	x	0.7	=	43.02	(74)
North	0.9x	0.77	x	1.76	x	79.99	x	0.63	x	0.7	=	43.02	(74)
North	0.9x	0.77	x	4.39	x	79.99	x	0.63	x	0.7	=	107.31	(74)
North	0.9x	0.77	x	1.76	x	74.68	x	0.63	x	0.7	=	40.17	(74)
North	0.9x	0.77	x	1.76	x	74.68	x	0.63	x	0.7	=	40.17	(74)
North	0.9x	0.77	x	4.39	x	74.68	x	0.63	x	0.7	=	100.19	(74)
North	0.9x	0.77	x	1.76	x	59.25	x	0.63	x	0.7	=	31.87	(74)
North	0.9x	0.77	x	1.76	x	59.25	x	0.63	x	0.7	=	31.87	(74)
North	0.9x	0.77	x	4.39	x	59.25	x	0.63	x	0.7	=	79.49	(74)
North	0.9x	0.77	x	1.76	x	41.52	x	0.63	x	0.7	=	22.33	(74)
North	0.9x	0.77	x	1.76	x	41.52	x	0.63	x	0.7	=	22.33	(74)
North	0.9x	0.77	x	4.39	x	41.52	x	0.63	x	0.7	=	55.7	(74)
North	0.9x	0.77	x	1.76	x	24.19	x	0.63	x	0.7	=	13.01	(74)
North	0.9x	0.77	x	1.76	x	24.19	x	0.63	x	0.7	=	13.01	(74)
North	0.9x	0.77	x	4.39	x	24.19	x	0.63	x	0.7	=	32.45	(74)
North	0.9x	0.77	x	1.76	x	13.12	x	0.63	x	0.7	=	7.06	(74)
North	0.9x	0.77	x	1.76	x	13.12	x	0.63	x	0.7	=	7.06	(74)
North	0.9x	0.77	x	4.39	x	13.12	x	0.63	x	0.7	=	17.6	(74)
North	0.9x	0.77	x	1.76	x	8.86	x	0.63	x	0.7	=	4.77	(74)
North	0.9x	0.77	x	1.76	x	8.86	x	0.63	x	0.7	=	4.77	(74)
North	0.9x	0.77	x	4.39	x	8.86	x	0.63	x	0.7	=	11.89	(74)
West	0.9x	0.77	x	5.05	x	19.64	x	0.63	x	0.7	=	30.31	(80)
West	0.9x	0.77	x	2.64	x	19.64	x	0.63	x	0.7	=	15.85	(80)
West	0.9x	0.77	x	5.05	x	38.42	x	0.63	x	0.7	=	59.3	(80)
West	0.9x	0.77	x	2.64	x	38.42	x	0.63	x	0.7	=	31	(80)
West	0.9x	0.77	x	5.05	x	63.27	x	0.63	x	0.7	=	97.65	(80)

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West	0.9x	0.77	x	2.64	x	63.27	x	0.63	x	0.7	=	51.05	(80)
West	0.9x	0.77	x	5.05	x	92.28	x	0.63	x	0.7	=	142.42	(80)
West	0.9x	0.77	x	2.64	x	92.28	x	0.63	x	0.7	=	74.45	(80)
West	0.9x	0.77	x	5.05	x	113.09	x	0.63	x	0.7	=	174.54	(80)
West	0.9x	0.77	x	2.64	x	113.09	x	0.63	x	0.7	=	91.25	(80)
West	0.9x	0.77	x	5.05	x	115.77	x	0.63	x	0.7	=	178.67	(80)
West	0.9x	0.77	x	2.64	x	115.77	x	0.63	x	0.7	=	93.41	(80)
West	0.9x	0.77	x	5.05	x	110.22	x	0.63	x	0.7	=	170.1	(80)
West	0.9x	0.77	x	2.64	x	110.22	x	0.63	x	0.7	=	88.93	(80)
West	0.9x	0.77	x	5.05	x	94.68	x	0.63	x	0.7	=	146.12	(80)
West	0.9x	0.77	x	2.64	x	94.68	x	0.63	x	0.7	=	76.39	(80)
West	0.9x	0.77	x	5.05	x	73.59	x	0.63	x	0.7	=	113.57	(80)
West	0.9x	0.77	x	2.64	x	73.59	x	0.63	x	0.7	=	59.37	(80)
West	0.9x	0.77	x	5.05	x	45.59	x	0.63	x	0.7	=	70.36	(80)
West	0.9x	0.77	x	2.64	x	45.59	x	0.63	x	0.7	=	36.78	(80)
West	0.9x	0.77	x	5.05	x	24.49	x	0.63	x	0.7	=	37.8	(80)
West	0.9x	0.77	x	2.64	x	24.49	x	0.63	x	0.7	=	19.76	(80)
West	0.9x	0.77	x	5.05	x	16.15	x	0.63	x	0.7	=	24.93	(80)
West	0.9x	0.77	x	2.64	x	16.15	x	0.63	x	0.7	=	13.03	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	71.86	139.42	232.18	350.95	446.4	465.44	439.55	365.73	273.31	165.62	89.26	59.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	462.92	528.52	608.91	707.75	783.04	782.54	743.91	675.72	593.48	505.92	452.72	440.13	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.85	0.68	0.52	0.59	0.84	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.6	19.76	20.05	20.44	20.77	20.94	20.99	20.98	20.84	20.41	19.94	19.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.83	19.84	19.84	19.85	19.85	19.86	19.86	19.87	19.86	19.85	19.85	19.84	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.8	0.58	0.39	0.45	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.99	18.22	18.64	19.21	19.63	19.83	19.86	19.86	19.73	19.18	18.49	17.96	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.63	18.83	19.2	19.7	20.09	20.27	20.31	20.3	20.18	19.67	19.07	18.6	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.63	18.83	19.2	19.7	20.09	20.27	20.31	20.3	20.18	19.67	19.07	18.6	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.93	0.81	0.62	0.44	0.51	0.79	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	460.38	523.04	593.64	655.87	634.63	483.62	329.32	342.5	468.08	483.88	448.04	438.2	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1327.83	1287.77	1171.15	984.15	762.52	510.47	333.84	350.7	548.87	824.79	1093.31	1321.56	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	645.38	513.89	429.67	236.36	95.15	0	0	0	0	253.63	464.59	657.22	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3295.9 (98)

Space heating requirement in kWh/m²/year 46.57 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	645.38	513.89	429.67	236.36	95.15	0	0	0	0	253.63	464.59	657.22	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	690.25	549.62	459.54	252.79	101.77	0	0	0	0	271.26	496.89	702.91	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3525.03 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	190.12	167.62	176.13	158.03	154.96	138.6	133.24	146.03	145.71	163.86	173.09	185.59	
Efficiency of water heater												79.8	(216)
(217)m=	87.82	87.61	87.1	85.89	83.56	79.8	79.8	79.8	79.8	85.98	87.32	87.9	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	216.49	191.32	202.21	183.99	185.45	173.68	166.97	182.99	182.59	190.59	198.22	211.13	

Total = Sum(219a)$_{1...12}$ = 2285.64 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3525.03

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Water heating fuel used			2285.64	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			313.54	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	761.41	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	493.7	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1255.11	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	162.73	(268)
Total CO2, kg/year		sum of (265)…(271) =		1456.76	(272)

TER = 20.58 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-2-08

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.39	(1a) x	2.4	(2a) =	176.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			6.9	x1/[1/(1.2)+ 0.04]		=	7.9			(27)
Floor			73.39	x	0.11	=	8.0729			(28)
Walls Type1	40.92	17.94	22.98	x	0.18	=	4.14			(29)
Walls Type2	21.61	2.1	19.51	x	0.18	=	3.51			(29)
Total area of elements, m²			135.92							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	38.78	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		15.54	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	54.33	(37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	83.39	83.39	83.39	83.39	83.39	83.39	83.39	83.39	83.39	83.39	83.39	83.39	

Average = Sum(39)$_{1…12}$ /12= 83.39 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	

Average = Sum(40)$_{1…12}$ /12= 1.14 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	98.37	94.8	91.22	87.64	84.07	80.49	80.49	84.07	87.64	91.22	94.8	98.37	

Total = Sum(44)$_{1…12}$ = 1073.18 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.89	127.59	131.67	114.79	110.14	95.04	88.07	101.06	102.27	119.19	130.1	141.28	

Total = Sum(45)$_{1…12}$ = 1407.11 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.88	19.14	19.75	17.22	16.52	14.26	13.21	15.16	15.34	17.88	19.52	21.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.16	177.52	186.94	168.28	165.42	148.54	143.35	156.34	155.77	174.46	183.6	196.56	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.16	177.52	186.94	168.28	165.42	148.54	143.35	156.34	155.77	174.46	183.6	196.56

Output from water heater (annual)$_{1...12}$ — 2057.94 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.73	82.37	88	80.96	80.84	74.4	73.51	77.83	76.8	83.85	86.05	91.2	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.28	16.24	13.21	10	7.47	6.31	6.82	8.86	11.89	15.1	17.63	18.79	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.08	207.2	201.84	190.43	176.01	162.47	153.42	151.29	156.66	168.07	182.48	196.03	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	(71)

Water heating gains (Table 5)

(72)m=	124.64	122.57	118.28	112.45	108.66	103.33	98.8	104.6	106.67	112.7	119.52	122.58	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	405.88	403.9	391.21	370.75	350.03	329.99	316.92	322.64	333.1	353.76	377.51	395.28	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	6.9	x	19.64	x	0.5	x	0.8	=	37.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	6.9	x	38.42	x	0.5	x	0.8	=	73.49	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	6.9	x	63.27	x	0.5	x	0.8	=	121.02	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	6.9	x	92.28	x	0.5	x	0.8	=	176.5	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	6.9	x	113.09	x	0.5	x	0.8	=	216.31	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)

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West	0.9x	0.77	x	6.9	x	115.77	x	0.5	x	0.8	=	221.43	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	6.9	x	110.22	x	0.5	x	0.8	=	210.81	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	6.9	x	94.68	x	0.5	x	0.8	=	181.08	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	6.9	x	73.59	x	0.5	x	0.8	=	140.75	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	6.9	x	45.59	x	0.5	x	0.8	=	87.2	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	6.9	x	24.49	x	0.5	x	0.8	=	46.84	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	6.9	x	16.15	x	0.5	x	0.8	=	30.89	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	83.89	163.37	270.67	402.57	503.68	520.97	493.73	416.61	316.88	193.97	104.38	69.17	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	489.77	567.26	661.89	773.33	853.72	850.96	810.65	739.25	649.98	547.73	481.9	464.45	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.79	0.6	0.45	0.51	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.84	20	20.28	20.62	20.87	20.97	21	20.99	20.91	20.56	20.13	19.8	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.74	0.52	0.35	0.4	0.7	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.43	18.67	19.07	19.54	19.86	19.96	19.97	19.97	19.91	19.47	18.85	18.37	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19	19.2	19.55	19.98	20.26	20.36	20.38	20.38	20.31	19.91	19.36	18.94	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19	19.2	19.55	19.98	20.26	20.36	20.38	20.38	20.31	19.91	19.36	18.94	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.9	0.75	0.55	0.39	0.44	0.73	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	486.96	560.33	640.04	695.9	642.78	468.71	313.62	328.52	473.39	516.51	476.24	462.37	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1225.44	1192.42	1088.45	923.59	714.03	480.6	315.22	331.68	517.73	776.38	1022.5	1229.24	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	549.43	424.76	333.62	163.94	53.01	0	0	0	0	193.35	393.31	570.55	

Total per year (kWh/year) = Sum(98)1...5,9...12 =	2681.97	(98)
Space heating requirement in kWh/m²/year	36.54	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2681.97	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	2112.05	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	704.02	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2057.94	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1620.63	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	540.21	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	49.77	(313)

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Cooling System Energy Efficiency Ratio			0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =		0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside			47.49	(330a)
warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =		47.49	(331)
Energy for lighting (calculated in Appendix L)			322.88	(332)

12b. CO_2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	5558.03	x	0.22		1200.54	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1778.57	x	0.52		-923.08	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4264.82	x	0.22		921.2	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1364.74	x	0.52		-708.3	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	288.98	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	25.83	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	805.17	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					805.17	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	24.65	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	167.57	(379)
Total CO2, kg/year	sum of (376)…(382) =					997.39	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					13.59	(384)
EI rating (section 14)						88.71	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-2-08

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.39	(1a) x	2.4	(2a) =	176.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.39	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		176.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 2			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 3			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 4			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 5			6.25	x1/[1/(1.4)+ 0.04]		=	8.29			(27)
Floor			73.39	x	0.13	=	9.5407			(28)
Walls Type1	40.92	16.25	24.67	x	0.18	=	4.44			(29)
Walls Type2	21.61	2.1	19.51	x	0.18	=	3.51			(29)
Total area of elements, m²			135.92							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 41.14 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 13.59 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 54.73 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.09	34.86	34.63	33.55	33.35	32.41	32.41	32.24	32.77	33.35	33.76	34.18	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	89.82	89.59	89.36	88.28	88.08	87.14	87.14	86.97	87.5	88.08	88.49	88.91	

Average = Sum(39)$_{1…12}$ /12= 88.28 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.22	1.22	1.22	1.2	1.2	1.19	1.19	1.19	1.19	1.2	1.21	1.21	

Average = Sum(40)$_{1…12}$ /12= 1.2 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.37	94.8	91.22	87.64	84.07	80.49	80.49	84.07	87.64	91.22	94.8	98.37	

Total = Sum(44)$_{1…12}$ = 1073.18 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.89	127.59	131.67	114.79	110.14	95.04	88.07	101.06	102.27	119.19	130.1	141.28	

Total = Sum(45)$_{1…12}$ = 1407.11 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.88	19.14	19.75	17.22	16.52	14.26	13.21	15.16	15.34	17.88	19.52	21.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	192.48	169.68	178.26	159.88	156.74	140.14	134.67	147.66	147.36	165.78	175.19	187.88	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	192.48	169.68	178.26	159.88	156.74	140.14	134.67	147.66	147.36	165.78	175.19	187.88

Output from water heater (annual)$_{1…12}$ | 1955.72 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.78	76.09	81.05	74.24	73.9	67.68	66.56	70.88	70.08	76.91	79.33	84.25	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.29	16.24	13.21	10	7.47	6.31	6.82	8.86	11.9	15.1	17.63	18.79	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.08	207.2	201.84	190.43	176.01	162.47	153.42	151.29	156.66	168.07	182.48	196.03	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	(71)

Water heating gains (Table 5)

(72)m=	115.3	113.23	108.94	103.11	99.33	93.99	89.46	95.27	97.33	103.37	110.18	113.24	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	399.55	397.56	384.88	364.42	343.7	323.66	310.59	316.31	326.77	347.43	371.18	388.95	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	2.5	x	10.63	x	0.63	x	0.7	=	8.12	(74)
North	0.9x	0.77	x	2.5	x	10.63	x	0.63	x	0.7	=	8.12	(74)
North	0.9x	0.77	x	2.5	x	20.32	x	0.63	x	0.7	=	15.53	(74)
North	0.9x	0.77	x	2.5	x	20.32	x	0.63	x	0.7	=	15.53	(74)
North	0.9x	0.77	x	2.5	x	34.53	x	0.63	x	0.7	=	26.38	(74)
North	0.9x	0.77	x	2.5	x	34.53	x	0.63	x	0.7	=	26.38	(74)
North	0.9x	0.77	x	2.5	x	55.46	x	0.63	x	0.7	=	42.38	(74)
North	0.9x	0.77	x	2.5	x	55.46	x	0.63	x	0.7	=	42.38	(74)
North	0.9x	0.77	x	2.5	x	74.72	x	0.63	x	0.7	=	57.09	(74)
North	0.9x	0.77	x	2.5	x	74.72	x	0.63	x	0.7	=	57.09	(74)
North	0.9x	0.77	x	2.5	x	79.99	x	0.63	x	0.7	=	61.11	(74)
North	0.9x	0.77	x	2.5	x	79.99	x	0.63	x	0.7	=	61.11	(74)
North	0.9x	0.77	x	2.5	x	74.68	x	0.63	x	0.7	=	57.06	(74)
North	0.9x	0.77	x	2.5	x	74.68	x	0.63	x	0.7	=	57.06	(74)
North	0.9x	0.77	x	2.5	x	59.25	x	0.63	x	0.7	=	45.27	(74)
North	0.9x	0.77	x	2.5	x	59.25	x	0.63	x	0.7	=	45.27	(74)
North	0.9x	0.77	x	2.5	x	41.52	x	0.63	x	0.7	=	31.72	(74)
North	0.9x	0.77	x	2.5	x	41.52	x	0.63	x	0.7	=	31.72	(74)
North	0.9x	0.77	x	2.5	x	24.19	x	0.63	x	0.7	=	18.48	(74)
North	0.9x	0.77	x	2.5	x	24.19	x	0.63	x	0.7	=	18.48	(74)
North	0.9x	0.77	x	2.5	x	13.12	x	0.63	x	0.7	=	10.02	(74)
North	0.9x	0.77	x	2.5	x	13.12	x	0.63	x	0.7	=	10.02	(74)
North	0.9x	0.77	x	2.5	x	8.86	x	0.63	x	0.7	=	6.77	(74)
North	0.9x	0.77	x	2.5	x	8.86	x	0.63	x	0.7	=	6.77	(74)
West	0.9x	0.77	x	2.5	x	19.64	x	0.63	x	0.7	=	15.01	(80)
West	0.9x	0.77	x	2.5	x	19.64	x	0.63	x	0.7	=	15.01	(80)
West	0.9x	0.77	x	6.25	x	19.64	x	0.63	x	0.7	=	37.51	(80)
West	0.9x	0.77	x	2.5	x	38.42	x	0.63	x	0.7	=	29.35	(80)
West	0.9x	0.77	x	2.5	x	38.42	x	0.63	x	0.7	=	29.35	(80)
West	0.9x	0.77	x	6.25	x	38.42	x	0.63	x	0.7	=	73.39	(80)
West	0.9x	0.77	x	2.5	x	63.27	x	0.63	x	0.7	=	48.34	(80)
West	0.9x	0.77	x	2.5	x	63.27	x	0.63	x	0.7	=	48.34	(80)
West	0.9x	0.77	x	6.25	x	63.27	x	0.63	x	0.7	=	120.86	(80)
West	0.9x	0.77	x	2.5	x	92.28	x	0.63	x	0.7	=	70.5	(80)
West	0.9x	0.77	x	2.5	x	92.28	x	0.63	x	0.7	=	70.5	(80)
West	0.9x	0.77	x	6.25	x	92.28	x	0.63	x	0.7	=	176.26	(80)
West	0.9x	0.77	x	2.5	x	113.09	x	0.63	x	0.7	=	86.41	(80)
West	0.9x	0.77	x	2.5	x	113.09	x	0.63	x	0.7	=	86.41	(80)
West	0.9x	0.77	x	6.25	x	113.09	x	0.63	x	0.7	=	216.02	(80)
West	0.9x	0.77	x	2.5	x	115.77	x	0.63	x	0.7	=	88.45	(80)
West	0.9x	0.77	x	2.5	x	115.77	x	0.63	x	0.7	=	88.45	(80)

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West	0.9x	0.77	x	6.25	x	115.77	x	0.63	x	0.7	=	221.13	(80)
West	0.9x	0.77	x	2.5	x	110.22	x	0.63	x	0.7	=	84.21	(80)
West	0.9x	0.77	x	2.5	x	110.22	x	0.63	x	0.7	=	84.21	(80)
West	0.9x	0.77	x	6.25	x	110.22	x	0.63	x	0.7	=	210.53	(80)
West	0.9x	0.77	x	2.5	x	94.68	x	0.63	x	0.7	=	72.34	(80)
West	0.9x	0.77	x	2.5	x	94.68	x	0.63	x	0.7	=	72.34	(80)
West	0.9x	0.77	x	6.25	x	94.68	x	0.63	x	0.7	=	180.84	(80)
West	0.9x	0.77	x	2.5	x	73.59	x	0.63	x	0.7	=	56.22	(80)
West	0.9x	0.77	x	2.5	x	73.59	x	0.63	x	0.7	=	56.22	(80)
West	0.9x	0.77	x	6.25	x	73.59	x	0.63	x	0.7	=	140.56	(80)
West	0.9x	0.77	x	2.5	x	45.59	x	0.63	x	0.7	=	34.83	(80)
West	0.9x	0.77	x	2.5	x	45.59	x	0.63	x	0.7	=	34.83	(80)
West	0.9x	0.77	x	6.25	x	45.59	x	0.63	x	0.7	=	87.08	(80)
West	0.9x	0.77	x	2.5	x	24.49	x	0.63	x	0.7	=	18.71	(80)
West	0.9x	0.77	x	2.5	x	24.49	x	0.63	x	0.7	=	18.71	(80)
West	0.9x	0.77	x	6.25	x	24.49	x	0.63	x	0.7	=	46.78	(80)
West	0.9x	0.77	x	2.5	x	16.15	x	0.63	x	0.7	=	12.34	(80)
West	0.9x	0.77	x	2.5	x	16.15	x	0.63	x	0.7	=	12.34	(80)
West	0.9x	0.77	x	6.25	x	16.15	x	0.63	x	0.7	=	30.85	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	83.77	163.15	270.31	402.03	503	520.26	493.06	416.04	316.45	193.71	104.24	69.08	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	483.32	560.71	655.18	766.45	846.7	843.92	803.64	732.35	643.22	541.13	475.42	458.02	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.82	0.63	0.47	0.53	0.8	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.71	19.88	20.17	20.55	20.84	20.97	20.99	20.99	20.89	20.5	20.04	19.69	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.9	19.9	19.91	19.92	19.92	19.93	19.93	19.93	19.93	19.92	19.92	19.91	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.76	0.54	0.36	0.42	0.72	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.2	18.44	18.87	19.41	19.77	19.91	19.93	19.93	19.84	19.35	18.69	18.17	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.81	19.02	19.39	19.87	20.2	20.33	20.35	20.35	20.26	19.81	19.23	18.78	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.81	19.02	19.39	19.87	20.2	20.33	20.35	20.35	20.26	19.81	19.23	18.78	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.77	0.57	0.4	0.46	0.75	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	480.66	554.33	635.65	697.4	655.63	483.1	324.74	339.15	482.05	513.34	470.23	456.05	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1302.94	1264.95	1152.01	968.15	748.29	499.44	327.13	343.66	539.06	811.32	1073.16	1296.02	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	611.78	477.54	384.17	194.94	68.94	0	0	0	0	221.7	434.11	624.94	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3018.11 (98)

Space heating requirement in kWh/m²/year 41.12 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	611.78	477.54	384.17	194.94	68.94	0	0	0	0	221.7	434.11	624.94		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	654.31	510.73	410.88	208.49	73.73	0	0	0	0	237.11	464.29	668.38		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3227.92	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	192.48	169.68	178.26	159.88	156.74	140.14	134.67	147.66	147.36	165.78	175.19	187.88		
Efficiency of water heater													79.8	(216)
(217)m=	87.69	87.43	86.81	85.34	82.79	79.8	79.8	79.8	79.8	85.59	87.14	87.78		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	219.51	194.08	205.34	187.34	189.32	175.61	168.76	185.04	184.67	193.69	201.05	214.03		
Total = Sum(219a)$_{1...12}$ =													2318.44	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3227.92

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Water heating fuel used			2318.44	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			322.93	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	697.23	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	500.78	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1198.01	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	167.6	(268)
Total CO2, kg/year		sum of (265)…(271) =		1404.54	(272)

TER = 19.14 (273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-3-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.98	(1a) x	2.4	(2a) =	172.75	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.98	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	172.75	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 2			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Walls Type1	41.71	17.94	23.77	x	0.18	=	4.28			(29)
Walls Type2	11.24	2.1	9.14	x	0.18	=	1.65			(29)
Total area of elements, m²			52.95							(31)
Party wall			43.65	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.99 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.3 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 39.29 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	67.79	67.79	67.79	67.79	67.79	67.79	67.79	67.79	67.79	67.79	67.79	67.79

Average = Sum(39)$_{1…12}$ /12= 67.79 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94

Average = Sum(40)$_{1…12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.29 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.66 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.53	93.98	90.44	86.89	83.34	79.8	79.8	83.34	86.89	90.44	93.98	97.53

Total = Sum(44)$_{1…12}$ = 1063.97 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.63	126.5	130.54	113.8	109.2	94.23	87.32	100.2	101.39	118.17	128.99	140.07

Total = Sum(45)$_{1…12}$ = 1395.03 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.7	18.97	19.58	17.07	16.38	14.13	13.1	15.03	15.21	17.72	19.35	21.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.91	176.43	185.81	167.3	164.47	147.72	142.59	155.47	154.89	173.44	182.48	195.35	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.91	176.43	185.81	167.3	164.47	147.72	142.59	155.47	154.89	173.44	182.48	195.35	

Output from water heater (annual)$_{1…12}$	2045.87	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.31	82	87.62	80.63	80.53	74.13	73.25	77.54	76.51	83.51	85.68	90.8	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18	15.98	13	9.84	7.36	6.21	6.71	8.72	11.71	14.87	17.35	18.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	201.87	203.97	198.69	187.45	173.27	159.93	151.03	148.93	154.21	165.45	179.63	192.97	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	(71)

Water heating gains (Table 5)

(72)m=	124.08	122.03	117.77	111.99	108.24	102.95	98.46	104.22	106.26	112.25	119	122.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	401.34	399.38	386.86	366.68	346.26	326.49	313.59	319.27	329.58	349.96	373.39	390.9	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)

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North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)

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North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
East	0.9x	1	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(76)
East	0.9x	1	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(76)
East	0.9x	1	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(76)
East	0.9x	1	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(76)
East	0.9x	1	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(76)
East	0.9x	1	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(76)
East	0.9x	1	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(76)
East	0.9x	1	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(76)
East	0.9x	1	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(76)
East	0.9x	1	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(76)
East	0.9x	1	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(76)
East	0.9x	1	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	66.09	127.6	213.87	329.81	427.83	450.24	423.48	346.58	253.49	151.67	81.91	54.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	467.43	526.98	600.73	696.49	774.09	776.73	737.08	665.85	583.07	501.63	455.3	445.67	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.76	0.55	0.4	0.47	0.75	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.1	20.23	20.46	20.75	20.94	20.99	21	21	20.96	20.7	20.34	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.89	0.7	0.48	0.32	0.38	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.92	19.12	19.46	19.85	20.08	20.13	20.13	20.13	20.1	19.78	19.27	18.87	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.39	19.56	19.86	20.21	20.42	20.47	20.48	20.48	20.44	20.15	19.7	19.34	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.39	19.56	19.86	20.21	20.42	20.47	20.48	20.48	20.44	20.15	19.7	19.34	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.97	0.89	0.72	0.51	0.36	0.41	0.7	0.94	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	464.96	521.1	581.78	622.08	557.62	394.36	262.55	275.53	408.75	471.48	450.08	443.85	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1023.2	993.99	905.6	766.85	591.18	398.12	262.93	276.43	429.95	647.33	854.02	1026.69	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	415.34	317.78	240.92	104.23	24.96	0	0	0	0	130.83	290.83	433.63

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1958.52 (98)

Space heating requirement in kWh/m²/year 27.21 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1958.52	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1542.34	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	514.11	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		2045.87	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1611.12	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	537.04	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	42.05	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.58	(330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	46.58	(331)
Energy for lighting (calculated in Appendix L)		317.84	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4058.78	x	0.22		876.7	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1298.81	x	0.52		-674.08	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4239.79	x	0.22		915.8	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1356.73	x	0.52		-704.15	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	244.14	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	21.82	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	680.23	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					680.23	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	24.17	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	164.96	(379)
Total CO2, kg/year	sum of (376)…(382) =					869.36	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					12.08	(384)
EI rating (section 14)						90.04	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b2-3-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.98	(1a) x	2.4	(2a) =	172.75	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.98	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	172.75	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.69	x1/[1/(1.4)+ 0.04]		=	6.22			(27)
Windows Type 2			4.69	x1/[1/(1.4)+ 0.04]		=	6.22			(27)
Windows Type 3			2.45	x1/[1/(1.4)+ 0.04]		=	3.25			(27)
Windows Type 4			2.45	x1/[1/(1.4)+ 0.04]		=	3.25			(27)
Windows Type 5			1.63	x1/[1/(1.4)+ 0.04]		=	2.16			(27)
Walls Type1	41.71	15.91	25.8	x	0.18	=	4.64			(29)
Walls Type2	11.24	2.1	9.14	x	0.18	=	1.65			(29)
Total area of elements, m²			52.95							(31)
Party wall			43.65	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 29.48 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.98 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 34.46 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	34.51	34.28	34.05	32.98	32.78	31.84	31.84	31.67	32.2	32.78	33.18	33.61	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	68.98	68.74	68.51	67.44	67.24	66.3	66.3	66.13	66.66	67.24	67.65	68.07	

Average = Sum(39)$_{1...12}$ /12= 67.44 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.96	0.96	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.95	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.29 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.66 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.53	93.98	90.44	86.89	83.34	79.8	79.8	83.34	86.89	90.44	93.98	97.53	

Total = Sum(44)$_{1...12}$ = 1063.97 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.63	126.5	130.54	113.8	109.2	94.23	87.32	100.2	101.39	118.17	128.99	140.07	

Total = Sum(45)$_{1...12}$ = 1395.03 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.7	18.97	19.58	17.07	16.38	14.13	13.1	15.03	15.21	17.72	19.35	21.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.23	168.58	177.13	158.9	155.79	139.32	133.91	146.79	146.49	164.76	174.08	186.67	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.23	168.58	177.13	158.9	155.79	139.32	133.91	146.79	146.49	164.76	174.08	186.67

Output from water heater (annual)$_{1...12}$ | 1943.65 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.37	75.73	80.68	73.91	73.58	67.4	66.31	70.59	69.79	76.57	78.96	83.85	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18	15.99	13	9.84	7.36	6.21	6.71	8.73	11.71	14.87	17.36	18.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	201.87	203.97	198.69	187.45	173.27	159.93	151.03	148.93	154.21	165.45	179.63	192.97	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	(71)

Water heating gains (Table 5)

(72)m=	114.74	112.69	108.44	102.66	98.9	93.62	89.12	94.88	96.93	102.91	109.67	112.7	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	395.01	393.05	380.53	360.35	339.93	320.16	307.26	312.93	323.24	343.63	367.06	384.57	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.69	x	10.63	x	0.63	x	0.7	=	15.24	(74)
North	0.9x	0.77	x	2.45	x	10.63	x	0.63	x	0.7	=	7.96	(74)

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North	0.9x	0.77	x	2.45	x	10.63	x	0.63	x	0.7	=	7.96	(74)
North	0.9x	0.77	x	1.63	x	10.63	x	0.63	x	0.7	=	5.3	(74)
North	0.9x	0.77	x	4.69	x	20.32	x	0.63	x	0.7	=	29.13	(74)
North	0.9x	0.77	x	2.45	x	20.32	x	0.63	x	0.7	=	15.22	(74)
North	0.9x	0.77	x	2.45	x	20.32	x	0.63	x	0.7	=	15.22	(74)
North	0.9x	0.77	x	1.63	x	20.32	x	0.63	x	0.7	=	10.12	(74)
North	0.9x	0.77	x	4.69	x	34.53	x	0.63	x	0.7	=	49.49	(74)
North	0.9x	0.77	x	2.45	x	34.53	x	0.63	x	0.7	=	25.85	(74)
North	0.9x	0.77	x	2.45	x	34.53	x	0.63	x	0.7	=	25.85	(74)
North	0.9x	0.77	x	1.63	x	34.53	x	0.63	x	0.7	=	17.2	(74)
North	0.9x	0.77	x	4.69	x	55.46	x	0.63	x	0.7	=	79.5	(74)
North	0.9x	0.77	x	2.45	x	55.46	x	0.63	x	0.7	=	41.53	(74)
North	0.9x	0.77	x	2.45	x	55.46	x	0.63	x	0.7	=	41.53	(74)
North	0.9x	0.77	x	1.63	x	55.46	x	0.63	x	0.7	=	27.63	(74)
North	0.9x	0.77	x	4.69	x	74.72	x	0.63	x	0.7	=	107.09	(74)
North	0.9x	0.77	x	2.45	x	74.72	x	0.63	x	0.7	=	55.94	(74)
North	0.9x	0.77	x	2.45	x	74.72	x	0.63	x	0.7	=	55.94	(74)
North	0.9x	0.77	x	1.63	x	74.72	x	0.63	x	0.7	=	37.22	(74)
North	0.9x	0.77	x	4.69	x	79.99	x	0.63	x	0.7	=	114.65	(74)
North	0.9x	0.77	x	2.45	x	79.99	x	0.63	x	0.7	=	59.89	(74)
North	0.9x	0.77	x	2.45	x	79.99	x	0.63	x	0.7	=	59.89	(74)
North	0.9x	0.77	x	1.63	x	79.99	x	0.63	x	0.7	=	39.84	(74)
North	0.9x	0.77	x	4.69	x	74.68	x	0.63	x	0.7	=	107.04	(74)
North	0.9x	0.77	x	2.45	x	74.68	x	0.63	x	0.7	=	55.91	(74)
North	0.9x	0.77	x	2.45	x	74.68	x	0.63	x	0.7	=	55.91	(74)
North	0.9x	0.77	x	1.63	x	74.68	x	0.63	x	0.7	=	37.2	(74)
North	0.9x	0.77	x	4.69	x	59.25	x	0.63	x	0.7	=	84.92	(74)
North	0.9x	0.77	x	2.45	x	59.25	x	0.63	x	0.7	=	44.36	(74)
North	0.9x	0.77	x	2.45	x	59.25	x	0.63	x	0.7	=	44.36	(74)
North	0.9x	0.77	x	1.63	x	59.25	x	0.63	x	0.7	=	29.51	(74)
North	0.9x	0.77	x	4.69	x	41.52	x	0.63	x	0.7	=	59.51	(74)
North	0.9x	0.77	x	2.45	x	41.52	x	0.63	x	0.7	=	31.09	(74)
North	0.9x	0.77	x	2.45	x	41.52	x	0.63	x	0.7	=	31.09	(74)
North	0.9x	0.77	x	1.63	x	41.52	x	0.63	x	0.7	=	20.68	(74)
North	0.9x	0.77	x	4.69	x	24.19	x	0.63	x	0.7	=	34.67	(74)
North	0.9x	0.77	x	2.45	x	24.19	x	0.63	x	0.7	=	18.11	(74)
North	0.9x	0.77	x	2.45	x	24.19	x	0.63	x	0.7	=	18.11	(74)
North	0.9x	0.77	x	1.63	x	24.19	x	0.63	x	0.7	=	12.05	(74)
North	0.9x	0.77	x	4.69	x	13.12	x	0.63	x	0.7	=	18.8	(74)
North	0.9x	0.77	x	2.45	x	13.12	x	0.63	x	0.7	=	9.82	(74)
North	0.9x	0.77	x	2.45	x	13.12	x	0.63	x	0.7	=	9.82	(74)

North	0.9x	0.77	x	1.63	x	13.12	x	0.63	x	0.7	=	6.53	(74)
North	0.9x	0.77	x	4.69	x	8.86	x	0.63	x	0.7	=	12.71	(74)
North	0.9x	0.77	x	2.45	x	8.86	x	0.63	x	0.7	=	6.64	(74)
North	0.9x	0.77	x	2.45	x	8.86	x	0.63	x	0.7	=	6.64	(74)
North	0.9x	0.77	x	1.63	x	8.86	x	0.63	x	0.7	=	4.42	(74)
East	0.9x	1	x	4.69	x	19.64	x	0.63	x	0.7	=	28.15	(76)
East	0.9x	1	x	4.69	x	38.42	x	0.63	x	0.7	=	55.07	(76)
East	0.9x	1	x	4.69	x	63.27	x	0.63	x	0.7	=	90.69	(76)
East	0.9x	1	x	4.69	x	92.28	x	0.63	x	0.7	=	132.27	(76)
East	0.9x	1	x	4.69	x	113.09	x	0.63	x	0.7	=	162.1	(76)
East	0.9x	1	x	4.69	x	115.77	x	0.63	x	0.7	=	165.94	(76)
East	0.9x	1	x	4.69	x	110.22	x	0.63	x	0.7	=	157.98	(76)
East	0.9x	1	x	4.69	x	94.68	x	0.63	x	0.7	=	135.7	(76)
East	0.9x	1	x	4.69	x	73.59	x	0.63	x	0.7	=	105.48	(76)
East	0.9x	1	x	4.69	x	45.59	x	0.63	x	0.7	=	65.34	(76)
East	0.9x	1	x	4.69	x	24.49	x	0.63	x	0.7	=	35.1	(76)
East	0.9x	1	x	4.69	x	16.15	x	0.63	x	0.7	=	23.15	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	64.61	124.75	209.09	322.45	418.3	440.2	414.04	338.86	247.84	148.29	80.08	53.55	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	459.63	517.8	589.62	682.8	758.22	760.37	721.3	651.79	571.08	491.92	447.14	438.11	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.76	0.55	0.4	0.46	0.75	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.2	20.44	20.75	20.94	20.99	21	21	20.96	20.69	20.33	20.04	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.12	20.12	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.13	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.71	0.48	0.33	0.38	0.68	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.86	19.07	19.41	19.85	20.08	20.14	20.15	20.15	20.11	19.79	19.26	18.84	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.34	19.52	19.82	20.21	20.42	20.48	20.49	20.49	20.45	20.15	19.69	19.32	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.34	19.52	19.82	20.21	20.42	20.48	20.49	20.49	20.45	20.15	19.69	19.32	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.73	0.51	0.36	0.41	0.71	0.94	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	457.4	512.54	572.68	613.6	551.93	386.67	257.52	269.66	402.64	463.99	442.41	436.47	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1037.65	1004.93	912.75	762.48	586.5	390.11	257.86	270.44	423.38	641.99	851.54	1029.45	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	431.71	330.88	253.01	107.19	25.72	0	0	0	0	132.44	294.57	441.18

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2016.69 (98)

Space heating requirement in kWh/m²/year 28.02 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	431.71	330.88	253.01	107.19	25.72	0	0	0	0	132.44	294.57	441.18	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	461.72	353.88	270.6	114.64	27.51	0	0	0	0	141.64	315.05	471.85	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2156.88 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

191.23	168.58	177.13	158.9	155.79	139.32	133.91	146.79	146.49	164.76	174.08	186.67

Efficiency of water heater 79.8 (216)

(217)m=	86.92	86.58	85.76	83.79	81.16	79.8	79.8	79.8	79.8	84.24	86.21	87.03	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	220	194.71	206.53	189.63	191.96	174.59	167.81	183.95	183.57	195.59	201.93	214.48

Total = Sum(219a)$_{1...12}$ = 2324.75 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2156.88
Water heating fuel used		2324.75
Electricity for pumps, fans and electric keep-hot		

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central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			317.9	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	465.89	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	502.15	(264)
Space and water heating	(261) + (262) + (263) + (264) =			968.03	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	164.99	(268)
Total CO2, kg/year		sum of (265)…(271) =		1171.95	(272)

TER = 16.28 (273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-3-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.81	(1a) x	2.4	(2a) =	121.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.81	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	17.04	7.36	9.68	x	0.18	=	1.74			(29)
Walls Type2	19.18	2.1	17.08	x	0.18	=	3.07			(29)
Total area of elements, m²			36.22							(31)
Party wall			33.09	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.86 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 22.62 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	42.74	42.74	42.74	42.74	42.74	42.74	42.74	42.74	42.74	42.74	42.74	42.74	

Average = Sum(39)$_{1…12}$ /12= 42.74 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84

Average = Sum(40)$_{1…12}$ /12= 0.84 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.91 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.4	79.4	76.4	73.41	70.41	67.42	67.42	70.41	73.41	76.4	79.4	82.4	
										Total = Sum(44)$_{1…12}$ =		898.88	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	122.19	106.87	110.28	96.15	92.25	79.61	73.77	84.65	85.66	99.83	108.97	118.34	
										Total = Sum(45)$_{1…12}$ =		1178.57	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.33	16.03	16.54	14.42	13.84	11.94	11.07	12.7	12.85	14.97	16.35	17.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	177.47	156.8	165.56	149.64	147.53	133.1	129.05	139.93	139.16	155.11	162.47	173.61	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	177.47	156.8	165.56	149.64	147.53	133.1	129.05	139.93	139.16	155.11	162.47	173.61	

Output from water heater (annual)$_{1...12}$ 1829.41 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.85	75.48	80.89	74.76	74.9	69.26	68.75	72.37	71.28	77.42	79.03	83.57	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.8	12.26	9.97	7.55	5.64	4.76	5.15	6.69	8.98	11.4	13.3	14.18	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	149.34	150.89	146.98	138.67	128.17	118.31	111.72	110.17	114.08	122.39	132.89	142.75	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	(71)

Water heating gains (Table 5)

(72)m=	114.05	112.32	108.72	103.84	100.67	96.2	92.41	97.27	99	104.05	109.76	112.32	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	325.89	324.17	314.38	298.76	283.19	267.98	257.98	262.84	270.76	286.55	304.66	317.96	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)

East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	40.07	78.39	129.09	188.27	230.73	236.19	224.87	193.16	150.14	93.01	49.96	32.95	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	365.96	402.55	443.47	487.03	513.92	504.18	482.85	456	420.9	379.56	354.62	350.91	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.89	0.73	0.54	0.39	0.43	0.68	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.31	20.43	20.62	20.84	20.96	21	21	21	20.98	20.82	20.52	20.28	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.86	0.68	0.47	0.32	0.36	0.61	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.31	19.47	19.75	20.04	20.18	20.21	20.22	20.22	20.2	20.02	19.61	19.25	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.81	19.95	20.19	20.44	20.57	20.61	20.61	20.61	20.59	20.42	20.06	19.77	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.81	19.95	20.19	20.44	20.57	20.61	20.61	20.61	20.59	20.42	20.06	19.77	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.87	0.71	0.51	0.35	0.39	0.64	0.91	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	362.48	395.2	423.23	424.73	363.89	255.12	171.22	179.63	270.96	343.89	347.36	348.31	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	663	643.43	585.06	493.15	379.23	256.69	171.35	179.88	277.55	419.62	554.14	665.36	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	223.59	166.81	120.4	49.27	11.41	0	0	0	0	56.34	148.88	235.89	

Total per year (kWh/year) = $\text{Sum}(98)_{1...5,9...12}$ = 1012.6 (98)

Space heating requirement in kWh/m²/year 19.93 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1012.6	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	797.42	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	265.81	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1829.41	
If DHW from community scheme:			
Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1440.66	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	480.22	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	29.84	(313)

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Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		32.88	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	32.88	(331)
Energy for lighting (calculated in Appendix L)		243.69	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	2098.47	x	0.22		453.27	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	671.51	x	0.52		-348.51	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	3791.22	x	0.22		818.9	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1213.19	x	0.52		-629.65	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	173.27	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	15.49	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	482.77	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					482.77	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	17.06	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	126.47	(379)
Total CO2, kg/year	sum of (376)…(382) =					626.31	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					12.33	(384)
EI rating (section 14)						91.24	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-3-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.81	(1a) x	2.4	(2a) =	121.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.81	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	17.04	7.36	9.68	x	0.18	=	1.74			(29)
Walls Type2	19.18	2.1	17.08	x	0.18	=	3.07			(29)
Total area of elements, m²			36.22							(31)
Party wall			33.09	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.67 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.27 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 19.94 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	24.17	24.01	23.86	23.14	23	22.37	22.37	22.25	22.61	23	23.27	23.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	44.11	43.95	43.8	43.08	42.94	42.31	42.31	42.19	42.55	42.94	43.21	43.5	

Average = Sum(39)$_{1…12}$ /12= 43.08 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.87	0.87	0.86	0.85	0.85	0.83	0.83	0.83	0.84	0.85	0.85	0.86	

Average = Sum(40)$_{1…12}$ /12= 0.85 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.91 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.4	79.4	76.4	73.41	70.41	67.42	67.42	70.41	73.41	76.4	79.4	82.4	
										Total = Sum(44)$_{1…12}$ =		898.88	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	122.19	106.87	110.28	96.15	92.25	79.61	73.77	84.65	85.66	99.83	108.97	118.34	
										Total = Sum(45)$_{1…12}$ =		1178.57	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.33	16.03	16.54	14.42	13.84	11.94	11.07	12.7	12.85	14.97	16.35	17.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.79	148.96	156.88	141.24	138.85	124.7	120.36	131.25	130.75	146.43	154.06	164.93	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.79	148.96	156.88	141.24	138.85	124.7	120.36	131.25	130.75	146.43	154.06	164.93	

Output from water heater (annual)$_{1...12}$ 1727.19 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.91	69.2	73.94	68.04	67.95	62.54	61.8	65.42	64.56	70.47	72.31	76.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	14.18	12.59	10.24	7.75	5.8	4.89	5.29	6.87	9.22	11.71	13.67	14.57	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	149.34	150.89	146.98	138.67	128.17	118.31	111.72	110.17	114.08	122.39	132.89	142.75	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	(71)
Water heating gains (Table 5)													
(72)m=	104.71	102.98	99.39	94.5	91.33	86.87	83.07	87.93	89.66	94.72	100.43	102.99	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	319.94	318.17	308.32	292.63	277.01	261.78	251.79	256.69	264.67	280.53	298.69	312.02	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	4.6	x	19.64	x	0.63	x	0.7	=	27.61	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	4.6	x	38.42	x	0.63	x	0.7	=	54.01	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	4.6	x	63.27	x	0.63	x	0.7	=	88.95	(76)

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East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	4.6	x	92.28	x	0.63	x	0.7	=	129.73	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	4.6	x	113.09	x	0.63	x	0.7	=	158.99	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	4.6	x	115.77	x	0.63	x	0.7	=	162.75	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	4.6	x	110.22	x	0.63	x	0.7	=	154.95	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	4.6	x	94.68	x	0.63	x	0.7	=	133.1	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	4.6	x	73.59	x	0.63	x	0.7	=	103.45	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	4.6	x	45.59	x	0.63	x	0.7	=	64.09	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	4.6	x	24.49	x	0.63	x	0.7	=	34.43	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	4.6	x	16.15	x	0.63	x	0.7	=	22.71	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	44.18	86.42	142.32	207.57	254.38	260.4	247.92	212.96	165.53	102.54	55.08	36.33	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	364.11	404.59	450.64	500.2	531.39	522.18	499.7	469.64	430.2	383.07	353.77	348.35	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.88	0.72	0.52	0.37	0.41	0.66	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.4	20.61	20.84	20.97	21	21	21	20.98	20.82	20.51	20.25	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.19	20.2	20.2	20.21	20.21	20.23	20.23	20.23	20.22	20.21	20.21	20.2	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.85	0.67	0.45	0.31	0.34	0.6	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.22	19.41	19.71	20.04	20.18	20.22	20.22	20.23	20.21	20.02	19.58	19.2	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.75	19.91	20.16	20.44	20.57	20.61	20.61	20.61	20.6	20.42	20.04	19.73	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.75	19.91	20.16	20.44	20.57	20.61	20.61	20.61	20.6	20.42	20.04	19.73	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.86	0.69	0.48	0.34	0.38	0.63	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	360.88	397.38	429.79	431.85	367.44	253.11	169.67	177.58	270.74	346.27	346.75	345.91	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	681.42	659.61	598.38	497.21	381.08	254.27	169.76	177.76	276.46	421.53	559.4	675.45	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	238.48	176.22	125.43	47.06	10.15	0	0	0	0	55.99	153.11	245.18	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1051.63 (98)

Space heating requirement in kWh/m²/year 20.7 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	238.48	176.22	125.43	47.06	10.15	0	0	0	0	55.99	153.11	245.18		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	255.06	188.47	134.15	50.33	10.86	0	0	0	0	59.89	163.75	262.22		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1124.73	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	168.79	148.96	156.88	141.24	138.85	124.7	120.36	131.25	130.75	146.43	154.06	164.93		
Efficiency of water heater													79.8	(216)
(217)m=	85.74	85.26	84.22	82.23	80.45	79.8	79.8	79.8	79.8	82.5	84.8	85.87		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	196.87	174.7	186.26	171.76	172.59	156.27	150.83	164.47	163.85	177.49	181.69	192.07		
Total = Sum(219a)$_{1...12}$ =													2088.85	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1124.73

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Water heating fuel used			2088.85	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			250.39	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	242.94	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	451.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =			694.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	129.95	(268)
Total CO2, kg/year		sum of (265)…(271) =		863.01	(272)

TER = 16.99 (273)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b2-3-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	74.09	(1a)	x	2.4	(2a)	=	177.82	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.09	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			177.82	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	31	12.88	18.12	x	0.18	=	3.26			(29)
Walls Type2	31.26	2.1	29.16	x	0.18	=	5.25			(29)
Total area of elements, m²			62.26							(31)
Party wall			31.88	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.78 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.15 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 35.93 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	65.27	65.27	65.27	65.27	65.27	65.27	65.27	65.27	65.27	65.27	65.27	65.27	

Average = Sum(39)$_{1…12}$ /12= 65.27 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88

Average = Sum(40)$_{1...12}$ /12= 0.88 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.34 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.8 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.78	95.19	91.6	88.01	84.42	80.82	80.82	84.42	88.01	91.6	95.19	98.78	
												Total = Sum(44)$_{1...12}$ = 1077.64	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	146.49	128.12	132.21	115.27	110.6	95.44	88.44	101.49	102.7	119.68	130.64	141.87	
												Total = Sum(45)$_{1...12}$ = 1412.96	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	21.97	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.4	17.95	19.6	21.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.77	178.05	187.49	168.76	165.88	148.93	143.72	156.76	156.19	174.96	184.14	197.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.77	178.05	187.49	168.76	165.88	148.93	143.72	156.76	156.19	174.96	184.14	197.15

Output from water heater (annual)$_{1…12}$ 2063.8 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.93	82.54	88.18	81.12	81	74.53	73.63	77.97	76.94	84.02	86.23	91.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.57	16.49	13.41	10.15	7.59	6.41	6.92	9	12.08	15.34	17.9	19.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	206.65	208.79	203.39	191.89	177.36	163.72	154.6	152.45	157.86	169.36	183.88	197.53	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	(71)

Water heating gains (Table 5)

(72)m=	124.91	122.83	118.52	112.67	108.87	103.51	98.96	104.79	106.86	112.93	119.77	122.84	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	408.24	406.23	393.44	372.82	351.94	331.75	318.6	324.36	334.92	355.74	379.67	397.57	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.6	x	10.63	x	0.5	x	0.8	=	13.56	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.5	x	0.8	=	25.91	(74)
North	0.9x	0.77	x	4.6	x	34.53	x	0.5	x	0.8	=	44.03	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.5	x	0.8	=	70.72	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.5	x	0.8	=	95.27	(74)

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North	0.9x	0.77	x	4.6	x	79.99	x	0.5	x	0.8	=	101.99	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.5	x	0.8	=	95.22	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.5	x	0.8	=	75.55	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.5	x	0.8	=	52.94	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.5	x	0.8	=	30.84	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.5	x	0.8	=	16.73	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.5	x	0.8	=	11.3	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

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East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	58.64	114.1	189.26	282.53	354.84	367.71	348.2	292.85	221.84	135.48	72.93	48.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	466.88	520.33	582.7	655.35	706.78	699.46	666.8	617.21	556.76	491.22	452.6	445.95	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.79	0.59	0.43	0.48	0.76	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.17	20.29	20.5	20.76	20.93	20.99	21	21	20.96	20.72	20.39	20.13	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.74	0.52	0.35	0.4	0.69	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.07	19.24	19.55	19.91	20.12	20.18	20.18	20.18	20.15	19.87	19.39	19.02	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.51	19.66	19.93	20.25	20.45	20.5	20.51	20.51	20.48	20.21	19.79	19.46	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.51	19.66	19.93	20.25	20.45	20.5	20.51	20.51	20.48	20.21	19.79	19.46	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.91	0.76	0.54	0.38	0.43	0.71	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	464.66	515.2	566.68	595.68	534.26	381.09	254.79	267.36	396.86	463.41	447.86	444.33	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	992.62	963.5	876.56	740.64	570.93	385.3	255.18	268.18	416.24	627.21	828.37	996.14	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	392.8	301.26	230.55	104.37	27.28	0	0	0	0	121.87	273.97	410.55	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = | 1862.65 | (98)

Space heating requirement in kWh/m²/year | 25.14 | (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1862.65	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1466.84	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	488.95	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2063.8	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1625.24	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	541.75	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	41.23	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.94	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	47.94	(331)
Energy for lighting (calculated in Appendix L)		327.88	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	3860.09	x	0.22	833.78	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1235.23	x	0.52	-641.08	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4276.95	x	0.22	923.82	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1368.62	x	0.52	-710.32	(366)

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Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	239.39	(368)
Electrical energy for heat distribution	[(313) x	0.52	=	21.4	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	666.98	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			666.98	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	24.88	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	170.17	(379)
Total CO2, kg/year	sum of (376)…(382) =			862.04	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			11.63	(384)
EI rating (section 14)				90.3	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-3-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.09	(1a) x	2.4	(2a) =	177.82	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.09	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	177.82	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	31	12.88	18.12	x	0.18	=	3.26			(29)
Walls Type2	31.26	2.1	29.16	x	0.18	=	5.25			(29)
Total area of elements, m²			62.26							(31)
Party wall			31.88	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	27.69	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		4.93	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	32.61	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.38	35.15	34.92	33.84	33.63	32.69	32.69	32.52	33.06	33.63	34.04	34.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	67.99	67.76	67.53	66.45	66.25	65.31	65.31	65.13	65.67	66.25	66.66	67.08	

Average = Sum(39)$_{1\ldots12}$ /12= 66.45 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.92	0.91	0.91	0.9	0.89	0.88	0.88	0.88	0.89	0.89	0.9	0.91	

Average = Sum(40)$_{1…12}$ /12= 0.9 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.34 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.8 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.78	95.19	91.6	88.01	84.42	80.82	80.82	84.42	88.01	91.6	95.19	98.78	
										Total = Sum(44)$_{1…12}$ =		1077.64	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	146.49	128.12	132.21	115.27	110.6	95.44	88.44	101.49	102.7	119.68	130.64	141.87	
										Total = Sum(45)$_{1…12}$ =		1412.96	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	21.97	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.4	17.95	19.6	21.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	193.09	170.21	178.81	160.36	157.2	140.53	135.03	148.08	147.79	166.28	175.74	188.47	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	193.09	170.21	178.81	160.36	157.2	140.53	135.03	148.08	147.79	166.28	175.74	188.47	

Output from water heater (annual)$_{1...12}$ | 1961.57 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.98	76.27	81.24	74.4	74.05	67.81	66.68	71.02	70.22	77.07	79.51	84.45	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.93	16.81	13.67	10.35	7.74	6.53	7.06	9.17	12.31	15.63	18.25	19.45	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	206.65	208.79	203.39	191.89	177.36	163.72	154.6	152.45	157.86	169.36	183.88	197.53	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	(71)

Water heating gains (Table 5)

(72)m=	115.57	113.5	109.19	103.33	99.53	94.18	89.63	95.46	97.53	103.59	110.43	113.51	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	402.26	400.22	387.37	366.69	345.75	325.54	312.4	318.2	328.82	349.7	373.68	391.61	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.6	x	10.63	x	0.63	x	0.7	=	14.95	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.63	x	0.7	=	28.57	(74)
North	0.9x	0.77	x	4.6	x	34.53	x	0.63	x	0.7	=	48.54	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.63	x	0.7	=	77.97	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.63	x	0.7	=	105.04	(74)

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North	0.9x	0.77	x	4.6	x	79.99	x	0.63	x	0.7	=	112.44	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.63	x	0.7	=	104.98	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.63	x	0.7	=	83.29	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.63	x	0.7	=	58.36	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.63	x	0.7	=	34.01	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.63	x	0.7	=	18.44	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.63	x	0.7	=	12.46	(74)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

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East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)
East	0.9x	1	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	64.65	125.79	208.65	311.49	391.22	405.4	383.89	322.86	244.58	149.37	80.41	53.33	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	466.91	526.01	596.02	678.17	736.96	730.94	696.29	641.07	573.4	499.07	454.09	444.94	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.77	0.56	0.41	0.47	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.25	20.48	20.76	20.94	20.99	21	21	20.96	20.72	20.37	20.09	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.16	20.16	20.17	20.17	20.18	20.18	20.19	20.18	20.17	20.17	20.16	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.72	0.5	0.34	0.38	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.96	19.16	19.49	19.9	20.12	20.18	20.18	20.18	20.15	19.85	19.35	18.94	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.42	19.6	19.89	20.24	20.45	20.5	20.51	20.51	20.48	20.2	19.76	19.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.42	19.6	19.89	20.24	20.45	20.5	20.51	20.51	20.48	20.2	19.76	19.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.9	0.74	0.52	0.37	0.42	0.7	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	464.75	520.77	579	611.4	545.26	382.21	255.01	267.04	400.96	469.91	449.38	443.36	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1028.36	995.8	904.03	753.85	579.34	385.59	255.31	267.7	418.78	635.92	843.65	1019.95	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	419.32	319.22	241.83	102.57	25.35	0	0	0	0	123.51	283.88	428.98	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1944.66 (98)

Space heating requirement in kWh/m²/year 26.25 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	419.32	319.22	241.83	102.57	25.35	0	0	0	0	123.51	283.88	428.98		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	448.48	341.42	258.64	109.7	27.11	0	0	0	0	132.09	303.61	458.8		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2079.85	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	193.09	170.21	178.81	160.36	157.2	140.53	135.03	148.08	147.79	166.28	175.74	188.47		
Efficiency of water heater													79.8	(216)
(217)m=	86.83	86.47	85.62	83.66	81.13	79.8	79.8	79.8	79.8	84.03	86.09	86.94		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	222.38	196.85	208.84	191.68	193.75	176.1	169.22	185.56	185.2	197.87	204.14	216.77		
Total = Sum(219a)$_{1...12}$ =													2348.36	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2079.85	
Water heating fuel used			2348.36	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			334.23	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	449.25	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	507.25	(264)
Space and water heating	(261) + (262) + (263) + (264) =				956.49	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	173.47	(268)

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Total CO2, kg/year	sum of (265)…(271) =	1168.89	(272)
TER =		15.78	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-3-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	75.18	(1a) x	2.4	(2a) =	180.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.18	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	180.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*			0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Walls Type1	41.41	15.41	26	x	0.18	=	4.68			(29)
Walls Type2	4.86	2.1	2.76	x	0.18	=	0.5			(29)
Total area of elements, m²			46.27							(31)
Party wall			42	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	25.34	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		9.45	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	34.79	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.56	64.56	64.56	64.56	64.56	64.56	64.56	64.56	64.56	64.56	64.56	64.56	

Average = Sum(39)$_{1…12}$ /12= 64.56 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86

Average = Sum(40)$_{1...12}$ /12= 0.86 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.37 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.37 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	99.41	95.79	92.18	88.56	84.95	81.33	81.33	84.95	88.56	92.18	95.79	99.41

Total = Sum(44)$_{1...12}$ = 1084.44 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.42	128.93	133.05	115.99	111.3	96.04	89	102.13	103.35	120.44	131.47	142.77

Total = Sum(45)$_{1...12}$ = 1421.87 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.11	19.34	19.96	17.4	16.69	14.41	13.35	15.32	15.5	18.07	19.72	21.41	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.69	178.86	188.32	169.49	166.58	149.54	144.27	157.4	156.84	175.72	184.96	198.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.69	178.86	188.32	169.49	166.58	149.54	144.27	157.4	156.84	175.72	184.96	198.04	

Output from water heater (annual)$_{1...12}$ 2072.71 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.24	82.81	88.46	81.36	81.23	74.73	73.81	78.18	77.16	84.27	86.51	91.69	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.64	16.56	13.46	10.19	7.62	6.43	6.95	9.03	12.13	15.4	17.97	19.16	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	209.07	211.24	205.78	194.14	179.44	165.64	156.41	154.24	159.71	171.35	186.04	199.85	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	(71)

Water heating gains (Table 5)

(72)m=	125.32	123.23	118.9	113	109.18	103.79	99.21	105.08	107.16	113.26	120.15	123.24	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.51	409.51	396.61	375.81	354.72	334.33	321.05	326.83	337.47	358.48	382.64	400.72	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(76)
East	0.9x	1	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(76)
East	0.9x	1	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(76)
East	0.9x	1	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(76)
East	0.9x	1	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(76)

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East	0.9x	1	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(76)
East	0.9x	1	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(76)
East	0.9x	1	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(76)
East	0.9x	1	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(76)
East	0.9x	1	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(76)
East	0.9x	1	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(76)
East	0.9x	1	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)

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South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	159.95	271.13	366.39	444.56	488.08	479.88	464.62	433.09	393.73	298.53	191.37	137.01	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	571.46	680.64	763	820.36	842.8	814.22	785.67	759.92	731.2	657.01	574.01	537.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.84	0.69	0.5	0.36	0.39	0.6	0.87	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.33	20.5	20.71	20.88	20.97	21	21	21	20.99	20.87	20.56	20.27	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.81	0.64	0.44	0.3	0.32	0.53	0.84	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.31	19.57	19.85	20.08	20.18	20.2	20.2	20.2	20.2	20.07	19.65	19.24	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.72	19.94	20.19	20.4	20.5	20.52	20.52	20.52	20.51	20.39	20.01	19.65	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.72	19.94	20.19	20.4	20.5	20.52	20.52	20.52	20.51	20.39	20.01	19.65	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.82	0.66	0.47	0.32	0.35	0.56	0.85	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	564.33	658.01	701.53	670.96	552.15	380.52	253.05	265.87	409.26	556.75	556.41	532.91	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	995.36	971.22	884.01	742.33	567.85	382.14	253.18	266.08	414.08	632.08	833.52	997.65	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	320.69	210.48	135.77	51.39	11.68	0	0	0	0	56.04	199.51	345.77	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1331.33 | (98)

Space heating requirement in kWh/m²/year | 17.71 | (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1331.33	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1048.42	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	349.47	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2072.71	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1632.26	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	544.09	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	35.74	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		48.65	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	48.65	(331)
Energy for lighting (calculated in Appendix L)		329.17	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	2759	x	0.22	595.95	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	882.88	x	0.52	-458.22	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4295.42	x	0.22	927.81	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1374.54	x	0.52	-713.38	(366)

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Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367b)
CO_2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	207.54	(368)
Electrical energy for heat distribution	[(313) x	0.52	=	18.55	(372)
Total CO_2 associated with community systems	(363)…(366) + (368)...(372)		=	578.24	(373)
CO_2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO_2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO_2 associated with space and water heating	(373) + (374) + (375) =			578.24	(376)
CO_2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	25.25	(378)
CO_2 associated with electricity for lighting	(332))) x	0.52	=	170.84	(379)
Total CO_2, kg/year	sum of (376)…(382) =			774.33	(383)
Dwelling CO_2 Emission Rate	(383) ÷ (4) =			10.3	(384)
EI rating (section 14)				91.37	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-3-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	75.18	(1a) x	2.4	(2a) =	180.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.18	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	180.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x 1	= 2.1			(26)
Windows Type 1			5.29	x1/[1/(1.4)+ 0.04]	= 7.01			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]	= 3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]	= 3.66			(27)
Windows Type 4			4.6	x1/[1/(1.4)+ 0.04]	= 6.1			(27)
Walls Type1	41.41	15.41	26	x 0.18	= 4.68			(29)
Walls Type2	4.86	2.1	2.76	x 0.18	= 0.5			(29)
Total area of elements, m²			46.27					(31)
Party wall			42	x 0	= 0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	27.71	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		4.13	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	31.84	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.83	35.6	35.36	34.28	34.08	33.14	33.14	32.96	33.5	34.08	34.49	34.92	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	67.67	67.44	67.21	66.12	65.92	64.98	64.98	64.8	65.34	65.92	66.33	66.76

Average = Sum(39)$_{1...12}$ /12= 66.12 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.9	0.9	0.89	0.88	0.88	0.86	0.86	0.86	0.87	0.88	0.88	0.89

Average = Sum(40)$_{1...12}$ /12= 0.88 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.37 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.37 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	99.41	95.79	92.18	88.56	84.95	81.33	81.33	84.95	88.56	92.18	95.79	99.41	
												Total = Sum(44)$_{1...12}$ = 1084.44	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	147.42	128.93	133.05	115.99	111.3	96.04	89	102.13	103.35	120.44	131.47	142.77	
												Total = Sum(45)$_{1...12}$ = 1421.87	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	22.11	19.34	19.96	17.4	16.69	14.41	13.35	15.32	15.5	18.07	19.72	21.41	(46)

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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	194.01	171.02	179.64	161.09	157.89	141.13	135.59	148.72	148.44	167.03	176.56	189.36	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	194.01	171.02	179.64	161.09	157.89	141.13	135.59	148.72	148.44	167.03	176.56	189.36	

Output from water heater (annual)$_{1...12}$ 1970.49 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.29	76.54	81.51	74.64	74.28	68.01	66.87	71.23	70.44	77.32	79.79	84.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.73	16.63	13.53	10.24	7.65	6.46	6.98	9.08	12.18	15.47	18.05	19.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	209.07	211.24	205.78	194.14	179.44	165.64	156.41	154.24	159.71	171.35	186.04	199.85	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	(71)

Water heating gains (Table 5)

(72)m=	115.98	113.9	109.56	103.67	99.84	94.45	89.88	95.74	97.83	103.93	110.81	113.91	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	405.26	403.25	390.34	369.52	348.42	328.03	314.75	320.54	331.2	352.22	376.39	394.48	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	5.29	x	19.64	x	0.63	x	0.7	=	31.75	(76)
East	0.9x	1	x	5.29	x	38.42	x	0.63	x	0.7	=	62.11	(76)
East	0.9x	1	x	5.29	x	63.27	x	0.63	x	0.7	=	102.29	(76)
East	0.9x	1	x	5.29	x	92.28	x	0.63	x	0.7	=	149.19	(76)
East	0.9x	1	x	5.29	x	113.09	x	0.63	x	0.7	=	182.84	(76)

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East	0.9x	1	x	5.29	x	115.77	x	0.63	x	0.7	=	187.17	(76)
East	0.9x	1	x	5.29	x	110.22	x	0.63	x	0.7	=	178.19	(76)
East	0.9x	1	x	5.29	x	94.68	x	0.63	x	0.7	=	153.06	(76)
East	0.9x	1	x	5.29	x	73.59	x	0.63	x	0.7	=	118.97	(76)
East	0.9x	1	x	5.29	x	45.59	x	0.63	x	0.7	=	73.7	(76)
East	0.9x	1	x	5.29	x	24.49	x	0.63	x	0.7	=	39.59	(76)
East	0.9x	1	x	5.29	x	16.15	x	0.63	x	0.7	=	26.11	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.63	x	0.7	=	65.72	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.63	x	0.7	=	107.64	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.63	x	0.7	=	137.12	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.63	x	0.7	=	154.97	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.63	x	0.7	=	161.49	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.63	x	0.7	=	155.41	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.63	x	0.7	=	151.85	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.63	x	0.7	=	147.46	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.63	x	0.7	=	143.23	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.63	x	0.7	=	116.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.63	x	0.7	=	77.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)

South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.63	x	0.7	=	56.79	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	176.35	298.92	403.95	490.12	538.11	529.07	512.25	477.48	434.08	329.12	210.99	151.05	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	581.61	702.17	794.29	859.64	886.53	857.1	826.99	798.02	765.28	681.34	587.37	545.53	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.93	0.83	0.67	0.48	0.35	0.37	0.58	0.87	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.28	20.47	20.69	20.89	20.97	21	21	21	20.99	20.87	20.54	20.24	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.17	20.18	20.19	20.2	20.2	20.2	20.19	20.19	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.79	0.62	0.42	0.28	0.31	0.52	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.21	19.5	19.8	20.06	20.16	20.2	20.2	20.2	20.19	20.06	19.61	19.17	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.64	19.89	20.16	20.39	20.49	20.52	20.52	20.52	20.51	20.38	19.98	19.6	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.64	19.89	20.16	20.39	20.49	20.52	20.52	20.52	20.51	20.38	19.98	19.6	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.91	0.8	0.64	0.45	0.31	0.33	0.54	0.84	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	574.2	677.65	726.57	691.08	564.78	383.14	254.52	266.8	414.55	570.86	568.47	540.48	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1037.92	1010.8	918.01	759.9	579.31	384.44	254.62	266.96	418.78	644.94	854.52	1027.89	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	345	223.88	142.43	49.55	10.81	0	0	0	0	55.11	205.96	362.63	

Total per year (kWh/year) = $Sum(98)_{1…5,9…12}$ = | 1395.37 | (98)

Space heating requirement in kWh/m²/year | 18.56 | (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system | 0 | (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =		1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =		1	(204)
Efficiency of main space heating system 1			93.5	(206)
Efficiency of secondary/supplementary heating system, %			0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	345	223.88	142.43	49.55	10.81	0	0	0	0	55.11	205.96	362.63		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	368.99	239.44	152.33	52.99	11.56	0	0	0	0	58.94	220.28	387.84		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1492.38	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	194.01	171.02	179.64	161.09	157.89	141.13	135.59	148.72	148.44	167.03	176.56	189.36		
Efficiency of water heater													79.8	(216)
(217)m=	86.33	85.53	84.2	82.08	80.41	79.8	79.8	79.8	79.8	82.21	85.23	86.52		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	224.73	199.94	213.34	196.25	196.36	176.86	169.91	186.37	186.01	203.18	207.17	218.86		
Total = Sum(219a)$_{1...12}$ =													2378.98	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1492.38	
Water heating fuel used			2378.98	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			330.71	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	322.35	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	513.86	(264)
Space and water heating	(261) + (262) + (263) + (264) =				836.21	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	171.64	(268)

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Total CO2, kg/year	sum of (265)…(271) =	1046.78	(272)
TER =		13.92	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-3-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	76.86	(1a) x	2.4	(2a) =	184.46	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76.86	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.46	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			6.9	x1/[1/(1.2)+ 0.04]		=	7.9			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	31.77	14.26	17.51	x	0.18	=	3.15			(29)
Walls Type2	23.59	2.1	21.49	x	0.18	=	3.87			(29)
Total area of elements, m²			55.36							(31)
Party wall			33.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.87 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.48 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 35.35 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	65.78	65.78	65.78	65.78	65.78	65.78	65.78	65.78	65.78	65.78	65.78	65.78	

Average = Sum(39)$_{1…12}$ /12= 65.78 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86

Average = Sum(40)$_{1...12}$ /12= 0.86 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.4 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.21 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.34	96.69	93.04	89.39	85.74	82.09	82.09	85.74	89.39	93.04	96.69	100.34	
										Total = Sum(44)$_{1...12}$ =		1094.57	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	148.79	130.14	134.29	117.08	112.34	96.94	89.83	103.08	104.31	121.56	132.7	144.1	
										Total = Sum(45)$_{1...12}$ =		1435.15	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	22.32	19.52	20.14	17.56	16.85	14.54	13.47	15.46	15.65	18.23	19.9	21.61	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	204.07	180.06	189.57	170.57	167.61	150.43	145.1	158.36	157.8	176.84	186.19	199.38	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	204.07	180.06	189.57	170.57	167.61	150.43	145.1	158.36	157.8	176.84	186.19	199.38

Output from water heater (annual)$_{1...12}$ 2085.99 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.7	83.21	88.87	81.72	81.57	75.03	74.09	78.5	77.48	84.64	86.92	92.13	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.01	16.88	13.73	10.39	7.77	6.56	7.09	9.21	12.37	15.7	18.33	19.54	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	212.75	214.96	209.4	197.55	182.6	168.55	159.16	156.96	162.52	174.36	189.31	203.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35	35	35	35	35	35	35	35	35	35	35	35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	(71)

Water heating gains (Table 5)

(72)m=	125.93	123.83	119.45	113.5	109.64	104.2	99.58	105.5	107.61	113.77	120.72	123.84	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	416.7	414.68	401.59	380.46	359.02	338.32	324.84	330.68	341.5	362.84	387.37	405.75	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	6.9	x	46.75	x	0.5	x	0.8	=	89.42	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	6.9	x	76.57	x	0.5	x	0.8	=	146.45	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)

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South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	6.9	x	97.53	x	0.5	x	0.8	=	186.55	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	6.9	x	110.23	x	0.5	x	0.8	=	210.84	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	6.9	x	114.87	x	0.5	x	0.8	=	219.71	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	6.9	x	110.55	x	0.5	x	0.8	=	211.44	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	6.9	x	108.01	x	0.5	x	0.8	=	206.59	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	6.9	x	104.89	x	0.5	x	0.8	=	200.63	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	6.9	x	101.89	x	0.5	x	0.8	=	194.87	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	6.9	x	82.59	x	0.5	x	0.8	=	157.96	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	6.9	x	55.42	x	0.5	x	0.8	=	106	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	6.9	x	40.4	x	0.5	x	0.8	=	77.27	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)

West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	164.06	273.48	359.33	422.01	452.71	440.98	428.65	406.82	381.09	298.15	195.39	141.14	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	580.77	688.16	760.91	802.47	811.73	779.3	753.49	737.5	722.59	660.98	582.76	546.88	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.86	0.72	0.54	0.38	0.41	0.62	0.88	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.33	20.5	20.69	20.86	20.96	21	21	21	20.99	20.87	20.56	20.28	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.83	0.67	0.47	0.31	0.34	0.55	0.84	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.31	19.56	19.83	20.06	20.17	20.2	20.2	20.2	20.2	20.07	19.65	19.24	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.72	19.94	20.18	20.38	20.49	20.52	20.52	20.52	20.51	20.39	20.01	19.65	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.72	19.94	20.18	20.38	20.49	20.52	20.52	20.52	20.51	20.39	20.01	19.65	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.93	0.84	0.69	0.5	0.34	0.37	0.58	0.85	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	573.69	666.21	704.51	672.01	557.6	387.09	257.87	270.91	416.22	564.06	565.32	542.08	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1014.25	989.29	899.73	755.24	578.18	389.39	258.05	271.19	421.91	643.79	849.26	1016.64	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	327.78	217.11	145.24	59.93	15.31	0	0	0	0	59.32	204.44	353.07	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 1382.2 (98)

Space heating requirement in kWh/m²/year 17.98 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

DER WorkSheet: New dwelling design stage

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1382.2	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1088.48	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	362.83	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2085.99	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1642.72	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	547.57	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	36.42	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		49.74	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	49.74	(331)
Energy for lighting (calculated in Appendix L)		335.67	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	2864.42	x	0.22	618.71	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	916.61	x	0.52	-475.72	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4322.94	x	0.22	933.75	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1383.34	x	0.52	-717.95	(366)

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Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	211.45	(368)
Electrical energy for heat distribution	[(313) x	0.52	=	18.9	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	589.14	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			589.14	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	25.81	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	174.21	(379)
Total CO2, kg/year	sum of (376)…(382) =			789.16	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			10.27	(384)
EI rating (section 14)				91.32	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-3-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	76.86	(1a) x	2.4	(2a) =	184.46	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76.86	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.46	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30 ÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.32	0.35	0.38	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			6.9	x1/[1/(1.4)+ 0.04]		=	9.15			(27)
Windows Type 2			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	31.77	14.26	17.51	x	0.18	=	3.15			(29)
Walls Type2	23.59	2.1	21.49	x	0.18	=	3.87			(29)
Total area of elements, m²			55.36							(31)
Party wall			33.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.03 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.64 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 32.66 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	36.52	36.29	36.06	34.97	34.76	33.82	33.82	33.64	34.18	34.76	35.18	35.61	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	69.19	68.95	68.72	67.63	67.43	66.48	66.48	66.3	66.84	67.43	67.84	68.27	

Average = Sum(39)$_{1…12}$ /12= 67.63 (39)

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Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.9	0.9	0.89	0.88	0.88	0.86	0.86	0.86	0.87	0.88	0.88	0.89	

Average = Sum(40)$_{1…12}$ /12= 0.88 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.4 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 91.21 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	100.34	96.69	93.04	89.39	85.74	82.09	82.09	85.74	89.39	93.04	96.69	100.34	

Total = Sum(44)$_{1…12}$ = 1094.57 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	148.79	130.14	134.29	117.08	112.34	96.94	89.83	103.08	104.31	121.56	132.7	144.1	

Total = Sum(45)$_{1…12}$ = 1435.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	22.32	19.52	20.14	17.56	16.85	14.54	13.47	15.46	15.65	18.23	19.9	21.61	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.39 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = — 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = — 0 (54)

Enter (50) or (54) in (55) — 0.75 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	195.39	172.22	180.88	162.17	158.93	142.03	136.42	149.67	149.4	168.16	177.79	190.69	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	195.39	172.22	180.88	162.17	158.93	142.03	136.42	149.67	149.4	168.16	177.79	190.69	

Output from water heater (annual)$_{1...12}$ 1983.77 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.75	76.94	81.93	75	74.63	68.31	67.14	71.55	70.76	77.7	80.19	85.19	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.28	17.13	13.93	10.54	7.88	6.65	7.19	9.35	12.54	15.93	18.59	19.82	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	212.75	214.96	209.4	197.55	182.6	168.55	159.16	156.96	162.52	174.36	189.31	203.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35	35	35	35	35	35	35	35	35	35	35	35	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	(71)

Water heating gains (Table 5)

(72)m=	116.6	114.49	110.12	104.17	100.31	94.87	90.25	96.17	98.27	104.43	111.38	114.5	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	410.64	408.59	395.45	374.28	352.8	332.08	318.61	324.48	335.35	356.73	381.3	399.69	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	6.9	x	46.75	x	0.63	x	0.7	=	98.59	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.63	x	0.7	=	26.29	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	6.9	x	76.57	x	0.63	x	0.7	=	161.46	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.63	x	0.7	=	43.06	(78)

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South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	6.9	x	97.53	x	0.63	x	0.7	=	205.67	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.63	x	0.7	=	54.85	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	6.9	x	110.23	x	0.63	x	0.7	=	232.45	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.63	x	0.7	=	61.99	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	6.9	x	114.87	x	0.63	x	0.7	=	242.23	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.63	x	0.7	=	64.6	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	6.9	x	110.55	x	0.63	x	0.7	=	233.12	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.63	x	0.7	=	62.16	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	6.9	x	108.01	x	0.63	x	0.7	=	227.77	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.63	x	0.7	=	60.74	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	6.9	x	104.89	x	0.63	x	0.7	=	221.19	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.63	x	0.7	=	58.99	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	6.9	x	101.89	x	0.63	x	0.7	=	214.85	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.63	x	0.7	=	57.29	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	6.9	x	82.59	x	0.63	x	0.7	=	174.15	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.63	x	0.7	=	46.44	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	6.9	x	55.42	x	0.63	x	0.7	=	116.86	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.63	x	0.7	=	31.16	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	6.9	x	40.4	x	0.63	x	0.7	=	85.19	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.63	x	0.7	=	22.72	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)

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West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	180.88	301.51	396.16	465.26	499.11	486.18	472.58	448.52	420.15	328.71	215.42	155.6	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	591.52	710.1	791.61	839.54	851.91	818.26	791.19	773	755.5	685.44	596.72	555.3	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.85	0.7	0.52	0.37	0.39	0.6	0.87	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.47	20.68	20.87	20.97	21	21	21	20.99	20.87	20.54	20.24	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.17	20.18	20.19	20.2	20.2	20.2	20.19	20.19	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.82	0.65	0.45	0.3	0.33	0.53	0.84	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.21	19.49	19.78	20.04	20.16	20.19	20.2	20.2	20.19	20.05	19.6	19.16	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.63	19.88	20.14	20.37	20.48	20.52	20.52	20.52	20.51	20.38	19.98	19.59	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.63	19.88	20.14	20.37	20.48	20.52	20.52	20.52	20.51	20.38	19.98	19.59	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.83	0.67	0.48	0.33	0.35	0.56	0.85	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	584.17	686.4	729.91	693.46	572.2	391.28	260.32	272.88	423.09	579.31	578.04	550.27	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1060.81	1032.73	937.19	775.78	591.98	393.24	260.47	273.11	428.3	659.16	873.55	1050.85	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	354.62	232.73	154.22	59.27	14.72	0	0	0	0	59.41	212.77	372.43	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = | 1460.17 | (98)

Space heating requirement in kWh/m²/year | 19 | (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system | 0 | (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =		1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =		1	(204)
Efficiency of main space heating system 1			93.5	(206)
Efficiency of secondary/supplementary heating system, %			0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	354.62	232.73	154.22	59.27	14.72	0	0	0	0	59.41	212.77	372.43		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	379.27	248.91	164.94	63.39	15.74	0	0	0	0	63.54	227.56	398.32		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1561.68	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	195.39	172.22	180.88	162.17	158.93	142.03	136.42	149.67	149.4	168.16	177.79	190.69		
Efficiency of water heater													79.8	(216)
(217)m=	86.39	85.62	84.39	82.41	80.61	79.8	79.8	79.8	79.8	82.34	85.29	86.57		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	226.18	201.15	214.34	196.79	197.17	177.98	170.96	187.56	187.22	204.22	208.44	220.28		
Total = Sum(219a)$_{1...12}$ =													2392.29	(219)

Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			1561.68	
Water heating fuel used			2392.29	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			340.54	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	337.32	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	516.74	(264)
Space and water heating	(261) + (262) + (263) + (264) =				854.06	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	176.74	(268)

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Total CO2, kg/year	sum of (265)…(271) =	1069.72	(272)
TER =		13.92	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-3-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.72	(1a) x	2.4	(2a) =	176.93	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.72	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.93	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Walls Type1	41.25	15.64	25.61	x	0.18	=	4.61			(29)
Walls Type2	4.81	2.1	2.71	x	0.18	=	0.49			(29)
Total area of elements, m²			46.06							(31)
Party wall			43.17	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	25.53	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		9.64	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	35.17	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.36	64.36	64.36	64.36	64.36	64.36	64.36	64.36	64.36	64.36	64.36	64.36	

Average = Sum(39)$_{1...12}$ /12= 64.36 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	

Average = Sum(40)$_{1...12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.61 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	98.57	94.98	91.4	87.82	84.23	80.65	80.65	84.23	87.82	91.4	94.98	98.57	

Total = Sum(44)$_{1...12}$ = 1075.29 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.17	127.84	131.92	115.01	110.36	95.23	88.25	101.26	102.47	119.42	130.36	141.56	

Total = Sum(45)$_{1...12}$ = 1409.88 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.93	19.18	19.79	17.25	16.55	14.28	13.24	15.19	15.37	17.91	19.55	21.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.45	177.77	187.2	168.51	165.64	148.73	143.52	156.54	155.97	174.7	183.85	196.84	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.45	177.77	187.2	168.51	165.64	148.73	143.52	156.54	155.97	174.7	183.85	196.84	

Output from water heater (annual)1…12	2060.72	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.82	82.45	88.09	81.04	80.92	74.46	73.56	77.89	76.87	83.93	86.14	91.29	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.35	16.3	13.25	10.03	7.5	6.33	6.84	8.89	11.94	15.16	17.69	18.86	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.82	207.95	202.57	191.12	176.65	163.06	153.98	151.84	157.22	168.68	183.14	196.74	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	(71)

Water heating gains (Table 5)

(72)m=	124.76	122.69	118.4	112.55	108.76	103.42	98.88	104.69	106.76	112.81	119.64	122.7	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	406.93	404.94	392.22	371.7	350.9	330.8	317.69	323.42	333.91	354.64	378.47	396.29	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)

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South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)

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West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	161.2	273.58	370.43	450.44	495.29	487.26	471.65	439.12	398.42	301.43	192.93	138.04	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	568.13	678.52	762.64	822.13	846.2	818.06	789.34	762.55	732.33	656.07	571.4	534.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.93	0.84	0.68	0.5	0.36	0.39	0.6	0.87	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.31	20.5	20.7	20.88	20.97	21	21	21	20.99	20.87	20.55	20.26	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.8	0.63	0.44	0.29	0.32	0.53	0.84	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.28	19.55	19.83	20.06	20.17	20.19	20.19	20.19	20.18	20.05	19.62	19.21	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.7	19.93	20.18	20.39	20.49	20.51	20.51	20.51	20.51	20.38	19.99	19.63	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.7	19.93	20.18	20.39	20.49	20.51	20.51	20.51	20.51	20.38	19.99	19.63	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.81	0.65	0.46	0.32	0.35	0.56	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	560.73	655.08	699.16	668.72	549.97	378.84	251.79	264.56	407.41	554.11	553.28	529.32	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	990.96	967.21	880.57	739.5	565.6	380.48	251.92	264.79	412.31	629.5	829.93	993.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	320.09	209.76	134.97	50.96	11.63	0	0	0	0	56.09	199.19	345.11

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1327.8 (98)

Space heating requirement in kWh/m²/year 18.01 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP 0.75 (303a)

Fraction of community heat from heat source 2 0.25 (303b)

Fraction of total space heat from Community CHP (302) x (303a) = 0.75 (304a)

Fraction of total space heat from community heat source 2 (302) x (303b) = 0.25 (304b)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 1327.8

Space heat from Community CHP (98) x (304a) x (305) x (306) = 1045.64 (307a)

Space heat from heat source 2 (98) x (304b) x (305) x (306) = 348.55 (307b)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 2060.72

If DHW from community scheme:

Water heat from Community CHP (64) x (303a) x (305) x (306) = 1622.81 (310a)

Water heat from heat source 2 (64) x (303b) x (305) x (306) = 540.94 (310b)

Electricity used for heat distribution 0.01 × [(307a)…(307e) + (310a)…(310e)] = 35.58 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside 47.7 (330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	47.7	(331)
Energy for lighting (calculated in Appendix L)		324.05	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	2751.69	x	0.22		594.37	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	880.54	x	0.52		-457	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4270.56	x	0.22		922.44	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1366.58	x	0.52		-709.25	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	206.59	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	18.47	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	575.61	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					575.61	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	24.76	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	168.18	(379)
Total CO2, kg/year	sum of (376)…(382) =					768.55	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					10.43	(384)
EI rating (section 14)						91.33	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-3-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.72	(1a) x	2.4	(2a) =	176.93	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.72	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.93	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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TER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.45	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 5			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Walls Type1	41.25	15.64	25.61	x	0.18	=	4.61			(29)
Walls Type2	4.81	2.1	2.71	x	0.18	=	0.49			(29)
Total area of elements, m²			46.06							(31)
Party wall			43.17	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	27.93	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		4.71	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	32.65	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	35.23	34.99	34.76	33.69	33.48	32.54	32.54	32.37	32.91	33.48	33.89	34.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	67.88	67.64	67.41	66.33	66.13	65.19	65.19	65.02	65.55	66.13	66.54	66.97	

Average = Sum(39)$_{1...12}$ /12= 66.33 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.92	0.92	0.91	0.9	0.9	0.88	0.88	0.88	0.89	0.9	0.9	0.91	

Average = Sum(40)$_{1...12}$ /12= 0.9 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.61 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.57	94.98	91.4	87.82	84.23	80.65	80.65	84.23	87.82	91.4	94.98	98.57	
										Total = Sum(44)$_{1...12}$ =		1075.29	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	146.17	127.84	131.92	115.01	110.36	95.23	88.25	101.26	102.47	119.42	130.36	141.56	
										Total = Sum(45)$_{1...12}$ =		1409.88	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	21.93	19.18	19.79	17.25	16.55	14.28	13.24	15.19	15.37	17.91	19.55	21.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3												0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	192.77	169.93	178.52	160.11	156.95	140.32	134.84	147.86	147.57	166.02	175.45	188.16	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	192.77	169.93	178.52	160.11	156.95	140.32	134.84	147.86	147.57	166.02	175.45	188.16	

Output from water heater (annual)$_{1...12}$ 1958.49 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.88	76.18	81.14	74.32	73.97	67.74	66.62	70.95	70.15	76.98	79.42	84.35	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.39	16.33	13.28	10.05	7.52	6.35	6.86	8.91	11.96	15.19	17.73	18.9	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.82	207.95	202.57	191.12	176.65	163.06	153.98	151.84	157.22	168.68	183.14	196.74	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	(71)

Water heating gains (Table 5)

(72)m=	115.43	113.36	109.06	103.22	99.42	94.08	89.54	95.36	97.42	103.47	110.3	113.37	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	400.63	398.64	385.91	365.38	344.58	324.48	311.37	317.11	327.6	348.34	372.17	390	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)

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South	0.9x	0.77	x	4.6	x	46.75	x	0.63	x	0.7	=	65.72	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.63	x	0.7	=	107.64	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.63	x	0.7	=	137.12	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.63	x	0.7	=	154.97	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.63	x	0.7	=	161.49	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.63	x	0.7	=	155.41	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.63	x	0.7	=	151.85	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.63	x	0.7	=	147.46	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.63	x	0.7	=	143.23	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.63	x	0.7	=	116.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.63	x	0.7	=	77.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.63	x	0.7	=	56.79	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)

West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	177.73	301.62	408.39	496.61	546.06	537.21	520	484.13	439.26	332.33	212.71	152.19	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	578.36	700.26	794.3	861.99	890.64	861.68	831.36	801.24	766.86	680.67	584.88	542.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.93	0.83	0.67	0.48	0.34	0.37	0.58	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.26	20.46	20.68	20.88	20.97	21	21	21	20.99	20.87	20.53	20.22	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.16	20.17	20.17	20.18	20.18	20.18	20.18	20.17	20.17	20.16	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.79	0.61	0.42	0.28	0.31	0.52	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.17	19.46	19.77	20.04	20.15	20.18	20.18	20.18	20.17	20.03	19.57	19.12	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.86	20.14	20.38	20.48	20.51	20.51	20.51	20.5	20.37	19.96	19.56	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.86	20.14	20.38	20.48	20.51	20.51	20.51	20.5	20.37	19.96	19.56	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.8	0.63	0.45	0.31	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	570.72	675.1	725.16	690.85	565.23	383.62	254.68	267	414.88	569.6	565.6	536.97	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1038.73	1011.96	919.38	761.3	580.39	385.03	254.79	267.18	419.43	645.91	855.43	1028.74	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	348.2	226.37	144.5	50.73	11.28	0	0	0	0	56.77	208.68	365.88

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1412.4 (98)

Space heating requirement in kWh/m²/year 19.16 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	348.2	226.37	144.5	50.73	11.28	0	0	0	0	56.77	208.68	365.88	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	372.41	242.11	154.54	54.25	12.06	0	0	0	0	60.72	223.18	391.32	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1510.59 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

192.77	169.93	178.52	160.11	156.95	140.32	134.84	147.86	147.57	166.02	175.45	188.16

Efficiency of water heater 79.8 (216)

(217)m=	86.37	85.58	84.26	82.14	80.44	79.8	79.8	79.8	79.8	82.28	85.28	86.56	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	223.18	198.56	211.88	194.93	195.13	175.84	168.97	185.29	184.92	201.77	205.74	217.38

Total = Sum(219a)$_{1...12}$ = 2363.59 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1510.59
Water heating fuel used		2363.59
Electricity for pumps, fans and electric keep-hot		

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central heating pump:		30	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		324.72	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	326.29	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	510.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =			836.82	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	168.53	(268)
Total CO2, kg/year		sum of (265)…(271) =		1044.28	(272)

TER = 14.17 (273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-3-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	92.81	(1a)	x	2.4	(2a)	=	222.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.81	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			222.74	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84		x1/[1/(1.2)+ 0.04]	=	2.11			(27)
Windows Type 2			1.84		x1/[1/(1.2)+ 0.04]	=	2.11			(27)
Windows Type 3			4.6		x1/[1/(1.2)+ 0.04]	=	5.27			(27)
Windows Type 4			5.29		x1/[1/(1.2)+ 0.04]	=	6.06			(27)
Windows Type 5			2.76		x1/[1/(1.2)+ 0.04]	=	3.16			(27)
Walls Type1	39.36	16.33	23.03	x	0.18	=	4.15			(29)
Walls Type2	23.43	2.1	21.33	x	0.18	=	3.84			(29)
Total area of elements, m²			62.79							(31)
Party wall			43.2	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 29.2 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.71 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 40.91 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	77.66	77.66	77.66	77.66	77.66	77.66	77.66	77.66	77.66	77.66	77.66	77.66	

Average = Sum(39)$_{1…12}$ /12= 77.66 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84

Average = Sum(40)$_{1…12}$ /12= 0.84 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.66 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	107.17	103.27	99.38	95.48	91.58	87.69	87.69	91.58	95.48	99.38	103.27	107.17	
Total = Sum(44)$_{1…12}$ =												1169.14	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	158.93	139	143.44	125.05	119.99	103.54	95.95	110.1	111.42	129.85	141.74	153.92	
Total = Sum(45)$_{1…12}$ =												1532.93	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	23.84	20.85	21.52	18.76	18	15.53	14.39	16.52	16.71	19.48	21.26	23.09	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	214.21	188.93	198.72	178.55	175.27	157.04	151.23	165.38	164.91	185.12	195.23	209.19	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	214.21	188.93	198.72	178.55	175.27	157.04	151.23	165.38	164.91	185.12	195.23	209.19

Output from water heater (annual)$_{1\ldots12}$ | 2183.77 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	97.07	86.16	91.91	84.38	84.12	77.22	76.12	80.83	79.84	87.4	89.92	95.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.91	19.46	15.82	11.98	8.96	7.56	8.17	10.62	14.25	18.1	21.12	22.52	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	244.15	246.69	240.3	226.71	209.55	193.43	182.66	180.12	186.51	200.1	217.26	233.38	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	(71)

Water heating gains (Table 5)

(72)m=	130.47	128.22	123.54	117.19	113.06	107.25	102.32	108.64	110.89	117.47	124.89	128.22	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	459.46	457.29	442.6	418.81	394.51	371.18	356.08	362.32	374.58	398.6	426.2	447.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)

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North	0.9x	0.77	x	4.6	x	10.63	x	0.5	x	0.8	=	13.56	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.5	x	0.8	=	25.91	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	4.6	x	34.53	x	0.5	x	0.8	=	44.03	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.5	x	0.8	=	70.72	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.5	x	0.8	=	95.27	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.5	x	0.8	=	101.99	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.5	x	0.8	=	95.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.5	x	0.8	=	75.55	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.5	x	0.8	=	52.94	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.5	x	0.8	=	30.84	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.5	x	0.8	=	16.73	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.5	x	0.8	=	11.3	(74)
West	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(80)

West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.23	132.37	220.45	333.22	423.85	441.92	417.35	347.25	259.5	157.25	84.75	56.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	527.69	589.67	663.05	752.03	818.36	813.1	773.42	709.57	634.08	555.85	510.96	503.44	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.94	0.81	0.6	0.44	0.5	0.78	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.17	20.29	20.49	20.75	20.93	20.99	21	21	20.96	20.71	20.39	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.76	0.53	0.36	0.42	0.72	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.11	19.27	19.57	19.93	20.16	20.22	20.22	20.22	20.19	19.88	19.42	19.06	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.68	19.94	20.26	20.47	20.53	20.53	20.53	20.5	20.22	19.81	19.49	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.68	19.94	20.26	20.47	20.53	20.53	20.53	20.5	20.22	19.81	19.49	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.93	0.78	0.56	0.39	0.45	0.74	0.96	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	526.19	585.95	650.14	696.15	635.1	455.33	304.97	319.88	470.83	532.69	507.59	502.37	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1183.02	1147.81	1043.77	882.29	681.04	460.25	305.39	320.86	496.82	746.78	986.8	1187.41	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	488.68	377.57	292.86	134.02	34.18	0	0	0	0	159.28	345.03	509.67

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2341.29 (98)

Space heating requirement in kWh/m²/year 25.23 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2341.29	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1843.76	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	614.59	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		2183.77	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1719.72	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	573.24	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	47.51	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		60.06	(330a)

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warm air heating system fans						0	(330b)
pump for solar water heating						0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =					60.06	(331)
Energy for lighting (calculated in Appendix L)						386.9	(332)

12b. CO_2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4852.01	x	0.22		1048.03	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1552.64	x	0.52		-805.82	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4525.58	x	0.22		977.53	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1448.19	x	0.52		-751.61	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	275.88	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	24.66	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)				=	768.67	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					768.67	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	31.17	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	200.8	(379)
Total CO2, kg/year	sum of (376)…(382) =					1000.64	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					10.78	(384)
EI rating (section 14)						90.27	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-3-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	92.81	(1a) x	2.4	(2a) =	222.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.81	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	222.74	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.38	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 2			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 3			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 4			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 5			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	39.36	16.33	23.03	x	0.18	=	4.15			(29)
Walls Type2	23.43	2.1	21.33	x	0.18	=	3.84			(29)
Total area of elements, m²			62.79							(31)
Party wall			43.2	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.73 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.01 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 37.75 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	43.14	42.89	42.65	41.51	41.29	40.3	40.3	40.11	40.68	41.29	41.73	42.18	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	80.89	80.64	80.4	79.25	79.04	78.05	78.05	77.86	78.43	79.04	79.47	79.92	

Average = Sum(39)$_{1...12}$ /12= 79.25 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.87	0.87	0.87	0.85	0.85	0.84	0.84	0.84	0.85	0.85	0.86	0.86

Average = Sum(40)$_{1...12}$ /12= 0.85 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.66 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	107.17	103.27	99.38	95.48	91.58	87.69	87.69	91.58	95.48	99.38	103.27	107.17

Total = Sum(44)$_{1...12}$ = 1169.14 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.93	139	143.44	125.05	119.99	103.54	95.95	110.1	111.42	129.85	141.74	153.92

Total = Sum(45)$_{1...12}$ = 1532.93 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.84	20.85	21.52	18.76	18	15.53	14.39	16.52	16.71	19.48	21.26	23.09	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.53	181.09	190.03	170.15	166.59	148.64	142.54	156.7	156.51	176.44	186.83	200.51	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.53	181.09	190.03	170.15	166.59	148.64	142.54	156.7	156.51	176.44	186.83	200.51

Output from water heater (annual)$_{1...12}$ | 2081.55 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.12	79.89	84.97	77.65	77.17	70.5	69.18	73.88	73.12	80.45	83.2	88.45	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.31	19.82	16.12	12.2	9.12	7.7	8.32	10.82	14.52	18.43	21.51	22.93	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	244.15	246.69	240.3	226.71	209.55	193.43	182.66	180.12	186.51	200.1	217.26	233.38	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	(71)

Water heating gains (Table 5)

(72)m=	121.13	118.88	114.21	107.85	103.73	97.92	92.98	99.31	101.56	108.13	115.56	118.89	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	453.53	451.32	436.56	412.7	388.34	364.98	349.89	356.18	368.51	392.6	420.26	441.14	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.84	x	10.63	x	0.63	x	0.7	=	5.98	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.63	x	0.7	=	5.98	(74)

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North	0.9x	0.77	x	4.6	x	10.63	x	0.63	x	0.7	=	14.95	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.63	x	0.7	=	11.43	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.63	x	0.7	=	11.43	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.63	x	0.7	=	28.57	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.63	x	0.7	=	19.42	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.63	x	0.7	=	19.42	(74)
North	0.9x	0.77	x	4.6	x	34.53	x	0.63	x	0.7	=	48.54	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.63	x	0.7	=	31.19	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.63	x	0.7	=	31.19	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.63	x	0.7	=	77.97	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.63	x	0.7	=	42.01	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.63	x	0.7	=	42.01	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.63	x	0.7	=	105.04	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.63	x	0.7	=	44.98	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.63	x	0.7	=	44.98	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.63	x	0.7	=	112.44	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.63	x	0.7	=	41.99	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.63	x	0.7	=	41.99	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.63	x	0.7	=	104.98	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.63	x	0.7	=	33.32	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.63	x	0.7	=	33.32	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.63	x	0.7	=	83.29	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.63	x	0.7	=	23.35	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.63	x	0.7	=	23.35	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.63	x	0.7	=	58.36	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.63	x	0.7	=	13.6	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.63	x	0.7	=	13.6	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.63	x	0.7	=	34.01	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.63	x	0.7	=	7.38	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.63	x	0.7	=	7.38	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.63	x	0.7	=	18.44	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.63	x	0.7	=	4.98	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.63	x	0.7	=	4.98	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.63	x	0.7	=	12.46	(74)
West	0.9x	0.77	x	5.29	x	19.64	x	0.63	x	0.7	=	31.75	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.63	x	0.7	=	62.11	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.63	x	0.7	=	102.29	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.63	x	0.7	=	149.19	(80)

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West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84 (80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.63	x	0.7	=	182.84 (80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39 (80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.63	x	0.7	=	187.17 (80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65 (80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.63	x	0.7	=	178.19 (80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97 (80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.63	x	0.7	=	153.06 (80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86 (80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.63	x	0.7	=	118.97 (80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07 (80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.63	x	0.7	=	73.7 (80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45 (80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.63	x	0.7	=	39.59 (80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66 (80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.63	x	0.7	=	26.11 (80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62 (80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	75.23	145.94	243.04	367.38	467.3	487.22	460.12	382.84	286.1	173.37	93.44	62.17	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	528.76	597.26	679.6	780.08	855.63	852.2	810.02	739.02	654.61	565.97	513.7	503.3	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.94	0.79	0.58	0.42	0.48	0.77	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.12	20.25	20.47	20.76	20.94	20.99	21	21	20.96	20.71	20.37	20.1	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.19	20.19	20.2	20.21	20.21	20.22	20.22	20.22	20.21	20.21	20.2	20.2	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.74	0.51	0.35	0.4	0.7	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.01	19.2	19.52	19.92	20.15	20.21	20.22	20.22	20.18	19.87	19.37	18.99	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.45	19.62	19.9	20.26	20.47	20.53	20.53	20.53	20.5	20.2	19.77	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.45	19.62	19.9	20.26	20.47	20.53	20.53	20.53	20.5	20.2	19.77	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.92	0.76	0.54	0.38	0.43	0.73	0.96	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	527.27	593.39	665.63	716.65	650.06	458.44	306.4	320.81	477.39	541.43	510.31	502.25	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1225.78	1186.78	1077.24	900.07	692.88	462.44	306.74	321.62	501.58	759.05	1006.98	1217.47	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	519.7	398.76	306.24	132.06	31.85	0	0	0	0	161.91	357.6	532.12

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2440.24 (98)

Space heating requirement in kWh/m²/year 26.29 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	519.7	398.76	306.24	132.06	31.85	0	0	0	0	161.91	357.6	532.12	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	555.82	426.48	327.52	141.24	34.07	0	0	0	0	173.16	382.46	569.12	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2609.88 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	205.53	181.09	190.03	170.15	166.59	148.64	142.54	156.7	156.51	176.44	186.83	200.51

Efficiency of water heater 79.8 (216)

(217)m=	87.19	86.86	86.08	84.15	81.34	79.8	79.8	79.8	79.8	84.59	86.52	87.3	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	235.73	208.48	220.76	202.2	204.79	186.26	178.63	196.36	196.13	208.59	215.94	229.69

Total = Sum(219a)$_{1...12}$ = 2483.57 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2609.88
Water heating fuel used		2483.57
Electricity for pumps, fans and electric keep-hot		

central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			394.08	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	563.73	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	536.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1100.19	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	204.53	(268)
Total CO2, kg/year		sum of (265)…(271) =		1343.64	(272)

TER = 14.48 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-3-08

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.39	(1a) x	2.4	(2a) =	176.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			6.9	x1/[1/(1.2)+ 0.04]		=	7.9			(27)
Walls Type1	40.92	17.94	22.98	x	0.18	=	4.14			(29)
Walls Type2	21.61	2.1	19.51	x	0.18	=	3.51			(29)
Total area of elements, m²			62.53							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.71 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.08 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 41.79 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	70.85	70.85	70.85	70.85	70.85	70.85	70.85	70.85	70.85	70.85	70.85	70.85	

Average = Sum(39)$_{1...12}$ /12= 70.85 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	

Average = Sum(40)$_{1...12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	98.37	94.8	91.22	87.64	84.07	80.49	80.49	84.07	87.64	91.22	94.8	98.37

Total = Sum(44)$_{1...12}$ = 1073.18 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.89	127.59	131.67	114.79	110.14	95.04	88.07	101.06	102.27	119.19	130.1	141.28

Total = Sum(45)$_{1...12}$ = 1407.11 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.88	19.14	19.75	17.22	16.52	14.26	13.21	15.16	15.34	17.88	19.52	21.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3												0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.16	177.52	186.94	168.28	165.42	148.54	143.35	156.34	155.77	174.46	183.6	196.56	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.16	177.52	186.94	168.28	165.42	148.54	143.35	156.34	155.77	174.46	183.6	196.56	

Output from water heater (annual)$_{1\ldots12}$ 2057.94 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.73	82.37	88	80.96	80.84	74.4	73.51	77.83	76.8	83.85	86.05	91.2	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.28	16.24	13.21	10	7.47	6.31	6.82	8.86	11.89	15.1	17.63	18.79	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.08	207.2	201.84	190.43	176.01	162.47	153.42	151.29	156.66	168.07	182.48	196.03	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	(71)

Water heating gains (Table 5)

(72)m=	124.64	122.57	118.28	112.45	108.66	103.33	98.8	104.6	106.67	112.7	119.52	122.58	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	405.88	403.9	391.21	370.75	350.03	329.99	316.92	322.64	333.1	353.76	377.51	395.28	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)

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North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	6.9	x	19.64	x	0.5	x	0.8	=	37.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	6.9	x	38.42	x	0.5	x	0.8	=	73.49	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	6.9	x	63.27	x	0.5	x	0.8	=	121.02	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	6.9	x	92.28	x	0.5	x	0.8	=	176.5	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	6.9	x	113.09	x	0.5	x	0.8	=	216.31	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	6.9	x	115.77	x	0.5	x	0.8	=	221.43	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)

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West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	6.9	x	110.22	x	0.5	x	0.8	=	210.81	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	6.9	x	94.68	x	0.5	x	0.8	=	181.08	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	6.9	x	73.59	x	0.5	x	0.8	=	140.75	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	6.9	x	45.59	x	0.5	x	0.8	=	87.2	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	6.9	x	24.49	x	0.5	x	0.8	=	46.84	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	6.9	x	16.15	x	0.5	x	0.8	=	30.89	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	83.89	163.37	270.67	402.57	503.68	520.97	493.73	416.61	316.88	193.97	104.38	69.17	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	489.77	567.26	661.89	773.33	853.72	850.96	810.65	739.25	649.98	547.73	481.9	464.45	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.89	0.72	0.53	0.38	0.44	0.71	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.08	20.23	20.49	20.78	20.95	20.99	21	21	20.96	20.71	20.33	20.04	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.86	0.67	0.46	0.31	0.36	0.63	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.88	19.11	19.48	19.87	20.06	20.11	20.11	20.11	20.09	19.79	19.25	18.82	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.36	19.56	19.88	20.23	20.42	20.46	20.47	20.47	20.44	20.16	19.68	19.31	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.36	19.56	19.88	20.23	20.42	20.46	20.47	20.47	20.44	20.16	19.68	19.31	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.87	0.69	0.48	0.34	0.39	0.66	0.93	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	486.85	559.4	634.62	671.52	588.19	411.94	273.62	287.33	431.29	507.62	475.53	462.36	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1067.18	1038.59	948.09	802.87	617.61	415.3	273.96	288.08	448.99	677.13	891.32	1070.45	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	431.76	322.01	233.22	94.58	21.89	0	0	0	0	126.12	299.37	452.42

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1981.37	(98)
Space heating requirement in kWh/m²/year	27	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1981.37	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1560.33	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	520.11	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		2057.94	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1620.63	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	540.21	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	42.41	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.49	(330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	47.49	(331)
Energy for lighting (calculated in Appendix L)		322.88	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit	32	(361)
Heat efficiency of CHP unit	38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4106.13	x	0.22		886.92	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1313.96	x	0.52		-681.95	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4264.82	x	0.22		921.2	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1364.74	x	0.52		-708.3	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	246.27	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	22.01	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)				=	686.16	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					686.16	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	24.65	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	167.57	(379)
Total CO2, kg/year	sum of (376)…(382) =					878.38	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					11.97	(384)
EI rating (section 14)						90.06	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: b2-3-08

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	73.39	(1a)	x	2.4	(2a)	=	176.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.39	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	176.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 2			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 3			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 4			2.5	x1/[1/(1.4)+ 0.04]		=	3.31			(27)
Windows Type 5			6.25	x1/[1/(1.4)+ 0.04]		=	8.29			(27)
Walls Type1	40.92	16.25	24.67	x	0.18	=	4.44			(29)
Walls Type2	21.61	2.1	19.51	x	0.18	=	3.51			(29)
Total area of elements, m²			62.53							(31)
Party wall			38.59	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.6 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.76 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 37.35 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	35.09	34.86	34.63	33.55	33.35	32.41	32.41	32.24	32.77	33.35	33.76	34.18	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	72.44	72.21	71.98	70.9	70.7	69.76	69.76	69.59	70.12	70.7	71.11	71.54	

Average = $Sum(39)_{1...12}$ /12= 70.9 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.99	0.98	0.98	0.97	0.96	0.95	0.95	0.95	0.96	0.96	0.97	0.97

Average = $Sum(40)_{1...12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	98.37	94.8	91.22	87.64	84.07	80.49	80.49	84.07	87.64	91.22	94.8	98.37

Total = $Sum(44)_{1...12}$ = 1073.18 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.89	127.59	131.67	114.79	110.14	95.04	88.07	101.06	102.27	119.19	130.1	141.28

Total = $Sum(45)_{1...12}$ = 1407.11 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.88	19.14	19.75	17.22	16.52	14.26	13.21	15.16	15.34	17.88	19.52	21.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	192.48	169.68	178.26	159.88	156.74	140.14	134.67	147.66	147.36	165.78	175.19	187.88	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	192.48	169.68	178.26	159.88	156.74	140.14	134.67	147.66	147.36	165.78	175.19	187.88	

Output from water heater (annual)$_{1...12}$	1955.72	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.78	76.09	81.05	74.24	73.9	67.68	66.56	70.88	70.08	76.91	79.33	84.25	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.29	16.24	13.21	10	7.47	6.31	6.82	8.86	11.9	15.1	17.63	18.79	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.08	207.2	201.84	190.43	176.01	162.47	153.42	151.29	156.66	168.07	182.48	196.03	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	(71)

Water heating gains (Table 5)

(72)m=	115.3	113.23	108.94	103.11	99.33	93.99	89.46	95.27	97.33	103.37	110.18	113.24	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	399.55	397.56	384.88	364.42	343.7	323.66	310.59	316.31	326.77	347.43	371.18	388.95	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.5	x	10.63	x	0.63	x	0.7	=	8.12	(74)
North	0.9x	0.77	x	2.5	x	10.63	x	0.63	x	0.7	=	8.12	(74)

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North	0.9x	0.77	x	2.5	x	20.32	x	0.63	x	0.7	=	15.53	(74)
North	0.9x	0.77	x	2.5	x	20.32	x	0.63	x	0.7	=	15.53	(74)
North	0.9x	0.77	x	2.5	x	34.53	x	0.63	x	0.7	=	26.38	(74)
North	0.9x	0.77	x	2.5	x	34.53	x	0.63	x	0.7	=	26.38	(74)
North	0.9x	0.77	x	2.5	x	55.46	x	0.63	x	0.7	=	42.38	(74)
North	0.9x	0.77	x	2.5	x	55.46	x	0.63	x	0.7	=	42.38	(74)
North	0.9x	0.77	x	2.5	x	74.72	x	0.63	x	0.7	=	57.09	(74)
North	0.9x	0.77	x	2.5	x	74.72	x	0.63	x	0.7	=	57.09	(74)
North	0.9x	0.77	x	2.5	x	79.99	x	0.63	x	0.7	=	61.11	(74)
North	0.9x	0.77	x	2.5	x	79.99	x	0.63	x	0.7	=	61.11	(74)
North	0.9x	0.77	x	2.5	x	74.68	x	0.63	x	0.7	=	57.06	(74)
North	0.9x	0.77	x	2.5	x	74.68	x	0.63	x	0.7	=	57.06	(74)
North	0.9x	0.77	x	2.5	x	59.25	x	0.63	x	0.7	=	45.27	(74)
North	0.9x	0.77	x	2.5	x	59.25	x	0.63	x	0.7	=	45.27	(74)
North	0.9x	0.77	x	2.5	x	41.52	x	0.63	x	0.7	=	31.72	(74)
North	0.9x	0.77	x	2.5	x	41.52	x	0.63	x	0.7	=	31.72	(74)
North	0.9x	0.77	x	2.5	x	24.19	x	0.63	x	0.7	=	18.48	(74)
North	0.9x	0.77	x	2.5	x	24.19	x	0.63	x	0.7	=	18.48	(74)
North	0.9x	0.77	x	2.5	x	13.12	x	0.63	x	0.7	=	10.02	(74)
North	0.9x	0.77	x	2.5	x	13.12	x	0.63	x	0.7	=	10.02	(74)
North	0.9x	0.77	x	2.5	x	8.86	x	0.63	x	0.7	=	6.77	(74)
North	0.9x	0.77	x	2.5	x	8.86	x	0.63	x	0.7	=	6.77	(74)
West	0.9x	0.77	x	2.5	x	19.64	x	0.63	x	0.7	=	15.01	(80)
West	0.9x	0.77	x	2.5	x	19.64	x	0.63	x	0.7	=	15.01	(80)
West	0.9x	0.77	x	6.25	x	19.64	x	0.63	x	0.7	=	37.51	(80)
West	0.9x	0.77	x	2.5	x	38.42	x	0.63	x	0.7	=	29.35	(80)
West	0.9x	0.77	x	2.5	x	38.42	x	0.63	x	0.7	=	29.35	(80)
West	0.9x	0.77	x	6.25	x	38.42	x	0.63	x	0.7	=	73.39	(80)
West	0.9x	0.77	x	2.5	x	63.27	x	0.63	x	0.7	=	48.34	(80)
West	0.9x	0.77	x	2.5	x	63.27	x	0.63	x	0.7	=	48.34	(80)
West	0.9x	0.77	x	6.25	x	63.27	x	0.63	x	0.7	=	120.86	(80)
West	0.9x	0.77	x	2.5	x	92.28	x	0.63	x	0.7	=	70.5	(80)
West	0.9x	0.77	x	2.5	x	92.28	x	0.63	x	0.7	=	70.5	(80)
West	0.9x	0.77	x	6.25	x	92.28	x	0.63	x	0.7	=	176.26	(80)
West	0.9x	0.77	x	2.5	x	113.09	x	0.63	x	0.7	=	86.41	(80)
West	0.9x	0.77	x	2.5	x	113.09	x	0.63	x	0.7	=	86.41	(80)
West	0.9x	0.77	x	6.25	x	113.09	x	0.63	x	0.7	=	216.02	(80)
West	0.9x	0.77	x	2.5	x	115.77	x	0.63	x	0.7	=	88.45	(80)
West	0.9x	0.77	x	2.5	x	115.77	x	0.63	x	0.7	=	88.45	(80)
West	0.9x	0.77	x	6.25	x	115.77	x	0.63	x	0.7	=	221.13	(80)
West	0.9x	0.77	x	2.5	x	110.22	x	0.63	x	0.7	=	84.21	(80)

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West	0.9x	0.77	x	2.5	x	110.22	x	0.63	x	0.7	=	84.21	(80)
West	0.9x	0.77	x	6.25	x	110.22	x	0.63	x	0.7	=	210.53	(80)
West	0.9x	0.77	x	2.5	x	94.68	x	0.63	x	0.7	=	72.34	(80)
West	0.9x	0.77	x	2.5	x	94.68	x	0.63	x	0.7	=	72.34	(80)
West	0.9x	0.77	x	6.25	x	94.68	x	0.63	x	0.7	=	180.84	(80)
West	0.9x	0.77	x	2.5	x	73.59	x	0.63	x	0.7	=	56.22	(80)
West	0.9x	0.77	x	2.5	x	73.59	x	0.63	x	0.7	=	56.22	(80)
West	0.9x	0.77	x	6.25	x	73.59	x	0.63	x	0.7	=	140.56	(80)
West	0.9x	0.77	x	2.5	x	45.59	x	0.63	x	0.7	=	34.83	(80)
West	0.9x	0.77	x	2.5	x	45.59	x	0.63	x	0.7	=	34.83	(80)
West	0.9x	0.77	x	6.25	x	45.59	x	0.63	x	0.7	=	87.08	(80)
West	0.9x	0.77	x	2.5	x	24.49	x	0.63	x	0.7	=	18.71	(80)
West	0.9x	0.77	x	2.5	x	24.49	x	0.63	x	0.7	=	18.71	(80)
West	0.9x	0.77	x	6.25	x	24.49	x	0.63	x	0.7	=	46.78	(80)
West	0.9x	0.77	x	2.5	x	16.15	x	0.63	x	0.7	=	12.34	(80)
West	0.9x	0.77	x	2.5	x	16.15	x	0.63	x	0.7	=	12.34	(80)
West	0.9x	0.77	x	6.25	x	16.15	x	0.63	x	0.7	=	30.85	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	83.77	163.15	270.31	402.03	503	520.26	493.06	416.04	316.45	193.71	104.24	69.08	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	483.32	560.71	655.18	766.45	846.7	843.92	803.64	732.35	643.22	541.13	475.42	458.02	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.73	0.52	0.38	0.44	0.71	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.2	20.46	20.77	20.95	20.99	21	21	20.96	20.71	20.32	20.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.09	20.1	20.1	20.11	20.11	20.12	20.12	20.13	20.12	20.11	20.11	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.87	0.67	0.45	0.31	0.35	0.64	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.81	19.05	19.43	19.86	20.07	20.12	20.12	20.13	20.1	19.78	19.23	18.79	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.3	19.51	19.84	20.23	20.42	20.47	20.47	20.47	20.44	20.15	19.66	19.28	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.3	19.51	19.84	20.23	20.42	20.47	20.47	20.47	20.44	20.15	19.66	19.28	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.87	0.69	0.48	0.34	0.39	0.66	0.93	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	480.64	553.47	629.89	668.25	586.34	406.44	269.98	282.91	427.53	502.98	469.53	456.1	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1086.97	1054.9	960.4	803.01	616.33	409.48	270.28	283.57	444.8	675.39	893.38	1078.59	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	451.11	336.96	245.9	97.03	22.31	0	0	0	0	128.27	305.17	463.13

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2049.88 (98)

Space heating requirement in kWh/m²/year 27.93 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	451.11	336.96	245.9	97.03	22.31	0	0	0	0	128.27	305.17	463.13	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	482.47	360.39	262.99	103.77	23.86	0	0	0	0	137.19	326.39	495.32	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2192.38 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

192.48	169.68	178.26	159.88	156.74	140.14	134.67	147.66	147.36	165.78	175.19	187.88

Efficiency of water heater 79.8 (216)

(217)m=	87.01	86.61	85.67	83.53	80.99	79.8	79.8	79.8	79.8	84.14	86.28	87.13	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	221.22	195.91	208.07	191.41	193.52	175.61	168.76	185.04	184.67	197.03	203.05	215.63

Total = Sum(219a)$_{1...12}$ = 2339.91 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2192.38
Water heating fuel used		2339.91
Electricity for pumps, fans and electric keep-hot		

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central heating pump:		30	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		322.93	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	473.55	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	505.42	(264)
Space and water heating	(261) + (262) + (263) + (264) =			978.98	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	167.6	(268)
Total CO2, kg/year		sum of (265)…(271) =		1185.5	(272)

TER = 16.15 (273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-9-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	76.86	(1a) x	2.4	(2a) =	184.46	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76.86	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.46	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			6.9	x1/[1/(1.2)+ 0.04]		=	7.9			(27)
Windows Type 2			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 3			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	31.77	14.26	17.51	x	0.18	=	3.15			(29)
Walls Type2	23.59	2.1	21.49	x	0.18	=	3.87			(29)
Roof	6.11	0	6.11	x	0.11	=	0.67			(30)
Total area of elements, m²			61.47							(31)
Party wall			33.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 26.54 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.23 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 38.77 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	69.21	69.21	69.21	69.21	69.21	69.21	69.21	69.21	69.21	69.21	69.21	69.21	

Average = Sum(39)$_{1...12}$ /12= 69.21 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9

Average = Sum(40)$_{1...12}$ /12= 0.9 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.4 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.21 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	100.34	96.69	93.04	89.39	85.74	82.09	82.09	85.74	89.39	93.04	96.69	100.34

Total = Sum(44)$_{1...12}$ = 1094.57 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	148.79	130.14	134.29	117.08	112.34	96.94	89.83	103.08	104.31	121.56	132.7	144.1

Total = Sum(45)$_{1...12}$ = 1435.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.32	19.52	20.14	17.56	16.85	14.54	13.47	15.46	15.65	18.23	19.9	21.61	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	204.07	180.06	189.57	170.57	167.61	150.43	145.1	158.36	157.8	176.84	186.19	199.38	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	204.07	180.06	189.57	170.57	167.61	150.43	145.1	158.36	157.8	176.84	186.19	199.38

Output from water heater (annual)$_{1…12}$	2085.99	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.7	83.21	88.87	81.72	81.57	75.03	74.09	78.5	77.48	84.64	86.92	92.13	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.01	16.88	13.73	10.39	7.77	6.56	7.09	9.21	12.37	15.7	18.33	19.54	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	212.75	214.96	209.4	197.55	182.6	168.55	159.16	156.96	162.52	174.36	189.31	203.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35	35	35	35	35	35	35	35	35	35	35	35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	(71)

Water heating gains (Table 5)

(72)m=	125.93	123.83	119.45	113.5	109.64	104.2	99.58	105.5	107.61	113.77	120.72	123.84	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	416.7	414.68	401.59	380.46	359.02	338.32	324.84	330.68	341.5	362.84	387.37	405.75	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	6.9	x	46.75	x	0.5	x	0.8	=	89.42	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)

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South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	6.9	x	76.57	x	0.5	x	0.8	=	146.45	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	6.9	x	97.53	x	0.5	x	0.8	=	186.55	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	6.9	x	110.23	x	0.5	x	0.8	=	210.84	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	6.9	x	114.87	x	0.5	x	0.8	=	219.71	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	6.9	x	110.55	x	0.5	x	0.8	=	211.44	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	6.9	x	108.01	x	0.5	x	0.8	=	206.59	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	6.9	x	104.89	x	0.5	x	0.8	=	200.63	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	6.9	x	101.89	x	0.5	x	0.8	=	194.87	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	6.9	x	82.59	x	0.5	x	0.8	=	157.96	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	6.9	x	55.42	x	0.5	x	0.8	=	106	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	6.9	x	40.4	x	0.5	x	0.8	=	77.27	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)

West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	164.06	273.48	359.33	422.01	452.71	440.98	428.65	406.82	381.09	298.15	195.39	141.14	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	580.77	688.16	760.91	802.47	811.73	779.3	753.49	737.5	722.59	660.98	582.76	546.88	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.88	0.74	0.56	0.4	0.43	0.64	0.89	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.26	20.44	20.64	20.83	20.95	20.99	21	21	20.98	20.83	20.5	20.21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.85	0.69	0.49	0.33	0.35	0.57	0.86	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.19	19.44	19.73	19.98	20.12	20.16	20.17	20.17	20.16	19.99	19.54	19.11	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.84	20.09	20.32	20.45	20.49	20.5	20.5	20.49	20.33	19.92	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.84	20.09	20.32	20.45	20.49	20.5	20.5	20.49	20.33	19.92	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.93	0.85	0.71	0.52	0.36	0.38	0.6	0.87	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	574.15	668.18	710.24	684.77	576.67	404.23	269.56	283.21	433.32	573.6	566.85	542.35	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1059.91	1033.93	940.66	790.31	605.72	407.91	269.88	283.7	441.96	673.33	887.38	1062.4	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	361.41	245.79	171.43	75.99	21.62	0	0	0	0	74.19	230.78	386.92	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1568.12 (98)

Space heating requirement in kWh/m²/year 20.4 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1568.12	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1234.89	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	411.63	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2085.99	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1642.72	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	547.57	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	38.37	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		49.74	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	49.74	(331)
Energy for lighting (calculated in Appendix L)		335.67	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		38	(362)

		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	3249.72	x	0.22	701.94	(363)

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less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1039.91	x	0.52		-539.71	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4322.94	x	0.22		933.75	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1383.34	x	0.52		-717.95	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	222.78	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	19.91	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	620.72	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					620.72	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	25.81	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	174.21	(379)
Total CO2, kg/year	sum of (376)…(382) =					820.75	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					10.68	(384)
EI rating (section 14)						90.97	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-9-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	76.86	(1a) x	2.4	(2a) =	184.46	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76.86	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.46	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.16	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.32	0.35	0.38	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			6.9	x1/[1/(1.4)+ 0.04]		=	9.15			(27)
Windows Type 2			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 3			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	31.77	14.26	17.51	x	0.18	=	3.15			(29)
Walls Type2	23.59	2.1	21.49	x	0.18	=	3.87			(29)
Roof	6.11	0	6.11	x	0.13	=	0.79			(30)
Total area of elements, m²			61.47							(31)
Party wall			33.4	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.82 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.07 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 35.89 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	36.52	36.29	36.06	34.97	34.76	33.82	33.82	33.64	34.18	34.76	35.18	35.61	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	72.42	72.18	71.95	70.86	70.66	69.71	69.71	69.53	70.07	70.66	71.07	71.5	

Average = Sum(39)$_{1…12}$ /12= 70.86 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.94	0.94	0.94	0.92	0.92	0.91	0.91	0.9	0.91	0.92	0.92	0.93	

Average = Sum(40)$_{1…12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.4 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.21 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	100.34	96.69	93.04	89.39	85.74	82.09	82.09	85.74	89.39	93.04	96.69	100.34	

Total = Sum(44)$_{1…12}$ = 1094.57 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	148.79	130.14	134.29	117.08	112.34	96.94	89.83	103.08	104.31	121.56	132.7	144.1	

Total = Sum(45)$_{1…12}$ = 1435.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.32	19.52	20.14	17.56	16.85	14.54	13.47	15.46	15.65	18.23	19.9	21.61	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	195.39	172.22	180.88	162.17	158.93	142.03	136.42	149.67	149.4	168.16	177.79	190.69	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	195.39	172.22	180.88	162.17	158.93	142.03	136.42	149.67	149.4	168.16	177.79	190.69

Output from water heater (annual)$_{1...12}$ | 1983.77 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.75	76.94	81.93	75	74.63	68.31	67.14	71.55	70.76	77.7	80.19	85.19	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.28	17.13	13.93	10.54	7.88	6.65	7.19	9.35	12.54	15.93	18.59	19.82	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	212.75	214.96	209.4	197.55	182.6	168.55	159.16	156.96	162.52	174.36	189.31	203.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35	35	35	35	35	35	35	35	35	35	35	35	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	(71)

Water heating gains (Table 5)

(72)m=	116.6	114.49	110.12	104.17	100.31	94.87	90.25	96.17	98.27	104.43	111.38	114.5	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	410.64	408.59	395.45	374.28	352.8	332.08	318.61	324.48	335.35	356.73	381.3	399.69	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	6.9	x	46.75	x	0.63	x	0.7	=	98.59	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.63	x	0.7	=	26.29	(78)

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South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	6.9	x	76.57	x	0.63	x	0.7	=	161.46	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.63	x	0.7	=	43.06	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	6.9	x	97.53	x	0.63	x	0.7	=	205.67	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.63	x	0.7	=	54.85	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	6.9	x	110.23	x	0.63	x	0.7	=	232.45	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.63	x	0.7	=	61.99	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	6.9	x	114.87	x	0.63	x	0.7	=	242.23	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.63	x	0.7	=	64.6	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	6.9	x	110.55	x	0.63	x	0.7	=	233.12	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.63	x	0.7	=	62.16	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	6.9	x	108.01	x	0.63	x	0.7	=	227.77	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.63	x	0.7	=	60.74	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	6.9	x	104.89	x	0.63	x	0.7	=	221.19	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.63	x	0.7	=	58.99	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	6.9	x	101.89	x	0.63	x	0.7	=	214.85	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.63	x	0.7	=	57.29	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	6.9	x	82.59	x	0.63	x	0.7	=	174.15	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.63	x	0.7	=	46.44	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	6.9	x	55.42	x	0.63	x	0.7	=	116.86	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.63	x	0.7	=	31.16	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	6.9	x	40.4	x	0.63	x	0.7	=	85.19	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.63	x	0.7	=	22.72	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)

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West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	180.88	301.51	396.16	465.26	499.11	486.18	472.58	448.52	420.15	328.71	215.42	155.6	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	591.52	710.1	791.61	839.54	851.91	818.26	791.19	773	755.5	685.44	596.72	555.3	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.87	0.73	0.54	0.39	0.41	0.62	0.89	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.41	20.62	20.83	20.95	20.99	21	21	20.98	20.84	20.49	20.17	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.13	20.13	20.14	20.15	20.15	20.16	20.16	20.16	20.16	20.15	20.15	20.14	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.83	0.67	0.47	0.31	0.34	0.55	0.85	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.09	19.37	19.68	19.97	20.11	20.16	20.16	20.16	20.15	19.98	19.5	19.04	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.54	19.79	20.06	20.31	20.45	20.49	20.5	20.5	20.48	20.32	19.89	19.5	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.54	19.79	20.06	20.31	20.45	20.49	20.5	20.5	20.48	20.32	19.89	19.5	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.93	0.84	0.69	0.5	0.34	0.37	0.58	0.86	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	584.56	688.2	735.32	706.17	590.68	407.66	271.36	284.51	439.49	588.69	579.48	550.5	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1103.43	1074.48	975.54	808.86	617.97	410.72	271.62	284.91	447.21	687	909.32	1093.7	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	386.04	259.58	178.72	73.94	20.3	0	0	0	0	73.15	237.48	404.14	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 1633.35 (98)

Space heating requirement in kWh/m²/year 21.25 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	386.04	259.58	178.72	73.94	20.3	0	0	0	0	73.15	237.48	404.14		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	412.88	277.63	191.15	79.08	21.72	0	0	0	0	78.23	253.99	432.23		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1746.9	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	195.39	172.22	180.88	162.17	158.93	142.03	136.42	149.67	149.4	168.16	177.79	190.69		
Efficiency of water heater													79.8	(216)
(217)m=	86.6	85.91	84.78	82.87	80.88	79.8	79.8	79.8	79.8	82.77	85.59	86.77		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	225.63	200.48	213.35	195.69	196.5	177.98	170.96	187.56	187.22	203.17	207.73	219.77		
Total = Sum(219a)$_{1...12}$ =													2386.04	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1746.9	
Water heating fuel used			2386.04	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			340.54	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	377.33	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	515.38	(264)
Space and water heating	(261) + (262) + (263) + (264) =			892.72	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	176.74	(268)
Total CO2, kg/year		sum of (265)…(271) =		1108.38	(272)

TER = 14.42 (273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-9-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.72	(1a) x	2.4	(2a) =	176.93	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.72	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.93	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 4			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 5			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	41.25	15.64	25.61	x	0.18	=	4.61			(29)
Walls Type2	4.81	2.1	2.71	x	0.18	=	0.49			(29)
Roof	70.23	0	70.23	x	0.11	=	7.73			(30)
Total area of elements, m²			116.29							(31)
Party wall			43.17	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 16.32 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 49.57 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.77	78.77	78.77	78.77	78.77	78.77	78.77	78.77	78.77	78.77	78.77	78.77	

Average = Sum(39)$_{1…12}$ /12= 78.77 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	

Average = Sum(40)$_{1…12}$ /12= 1.07 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.61 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.57	94.98	91.4	87.82	84.23	80.65	80.65	84.23	87.82	91.4	94.98	98.57	

Total = Sum(44)$_{1…12}$ = 1075.29 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.17	127.84	131.92	115.01	110.36	95.23	88.25	101.26	102.47	119.42	130.36	141.56	

Total = Sum(45)$_{1…12}$ = 1409.88 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.93	19.18	19.79	17.25	16.55	14.28	13.24	15.19	15.37	17.91	19.55	21.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.45	177.77	187.2	168.51	165.64	148.73	143.52	156.54	155.97	174.7	183.85	196.84	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.45	177.77	187.2	168.51	165.64	148.73	143.52	156.54	155.97	174.7	183.85	196.84

Output from water heater (annual)$_{1…12}$ — 2060.72 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.82	82.45	88.09	81.04	80.92	74.46	73.56	77.89	76.87	83.93	86.14	91.29	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.35	16.3	13.25	10.03	7.5	6.33	6.84	8.89	11.94	15.16	17.69	18.86	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.82	207.95	202.57	191.12	176.65	163.06	153.98	151.84	157.22	168.68	183.14	196.74	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	(71)

Water heating gains (Table 5)

(72)m=	124.76	122.69	118.4	112.55	108.76	103.42	98.88	104.69	106.76	112.81	119.64	122.7	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	406.93	404.94	392.22	371.7	350.9	330.8	317.69	323.42	333.91	354.64	378.47	396.29	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)

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West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	161.2	273.58	370.43	450.44	495.29	487.26	471.65	439.12	398.42	301.43	192.93	138.04	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	568.13	678.52	762.64	822.13	846.2	818.06	789.34	762.55	732.33	656.07	571.4	534.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.78	0.6	0.44	0.47	0.7	0.92	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.03	20.22	20.47	20.72	20.9	20.98	21	21	20.96	20.72	20.31	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.87	0.72	0.51	0.34	0.37	0.62	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.75	19.03	19.37	19.72	19.94	20.01	20.03	20.02	20	19.73	19.16	18.67	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.26	19.51	19.81	20.12	20.32	20.4	20.41	20.41	20.38	20.12	19.62	19.19	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.26	19.51	19.81	20.12	20.32	20.4	20.41	20.41	20.38	20.12	19.62	19.19	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.87	0.74	0.55	0.38	0.41	0.65	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	562.06	661.25	718.73	715.97	623.97	447.65	299.35	314.4	473.06	585.68	557.88	530.05	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1178.36	1150.42	1048.56	883.72	679.2	456.91	300.43	316.1	494.67	750.14	986.14	1180.99	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	458.53	328.72	245.4	120.78	41.09	0	0	0	0	122.36	308.35	484.31	

	Total per year (kWh/year) = $\text{Sum}(98)_{1\ldots5,9\ldots12}$ =	2109.54	(98)
Space heating requirement in kWh/m²/year		28.62	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2109.54	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1661.27	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	553.76	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2060.72	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1622.81	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	540.94	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.79	(313)

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Cooling System Energy Efficiency Ratio			0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =		0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside			47.7	(330a)
warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =		47.7	(331)
Energy for lighting (calculated in Appendix L)			324.05	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4371.75	x	0.22		944.3	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1398.96	x	0.52		-726.06	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4270.56	x	0.22		922.44	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1366.58	x	0.52		-709.25	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	254.25	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	22.73	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	708.4	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					708.4	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	24.76	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	168.18	(379)
Total CO2, kg/year	sum of (376)…(382) =					901.34	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					12.23	(384)
EI rating (section 14)						89.83	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: b2-9-06

Address :	Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	73.72	(1a)	x	2.4	(2a)	=	176.93	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.72	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			176.93	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.45	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 4			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 5			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	41.25	15.64	25.61	x	0.18	=	4.61			(29)
Walls Type2	4.81	2.1	2.71	x	0.18	=	0.49			(29)
Roof	70.23	0	70.23	x	0.13	=	9.13			(30)
Total area of elements, m²			116.29							(31)
Party wall			43.17	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.06 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 16.26 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 53.32 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.23	34.99	34.76	33.69	33.48	32.54	32.54	32.37	32.91	33.48	33.89	34.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.55	88.32	88.09	87.01	86.81	85.87	85.87	85.69	86.23	86.81	87.21	87.64	

Average = Sum(39)$_{1…12}$ /12= 87.01 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.2	1.2	1.19	1.18	1.18	1.16	1.16	1.16	1.17	1.18	1.18	1.19

Average = Sum(40)$_{1…12}$ /12= 1.18 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.61 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.57	94.98	91.4	87.82	84.23	80.65	80.65	84.23	87.82	91.4	94.98	98.57	

Total = Sum(44)$_{1…12}$ = 1075.29 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.17	127.84	131.92	115.01	110.36	95.23	88.25	101.26	102.47	119.42	130.36	141.56

Total = Sum(45)$_{1…12}$ = 1409.88 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.93	19.18	19.79	17.25	16.55	14.28	13.24	15.19	15.37	17.91	19.55	21.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	192.77	169.93	178.52	160.11	156.95	140.32	134.84	147.86	147.57	166.02	175.45	188.16	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	192.77	169.93	178.52	160.11	156.95	140.32	134.84	147.86	147.57	166.02	175.45	188.16

Output from water heater (annual)$_{1...12}$ | 1958.49 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.88	76.18	81.14	74.32	73.97	67.74	66.62	70.95	70.15	76.98	79.42	84.35	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.39	16.33	13.28	10.05	7.52	6.35	6.86	8.91	11.96	15.19	17.73	18.9	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.82	207.95	202.57	191.12	176.65	163.06	153.98	151.84	157.22	168.68	183.14	196.74	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	(71)

Water heating gains (Table 5)

(72)m=	115.43	113.36	109.06	103.22	99.42	94.08	89.54	95.36	97.42	103.47	110.3	113.37	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	400.63	398.64	385.91	365.38	344.58	324.48	311.37	317.11	327.6	348.34	372.17	390	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.63	x	0.7	=	65.72	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.63	x	0.7	=	39.43	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.63	x	0.7	=	107.64	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.63	x	0.7	=	64.58	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.63	x	0.7	=	137.12	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.63	x	0.7	=	82.27	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.63	x	0.7	=	154.97	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.63	x	0.7	=	92.98	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.63	x	0.7	=	161.49	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.63	x	0.7	=	96.89	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.63	x	0.7	=	155.41	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.63	x	0.7	=	93.25	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.63	x	0.7	=	151.85	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.63	x	0.7	=	91.11	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.63	x	0.7	=	147.46	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.63	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.63	x	0.7	=	143.23	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.63	x	0.7	=	85.94	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.63	x	0.7	=	116.1	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.63	x	0.7	=	69.66	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.63	x	0.7	=	77.91	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.63	x	0.7	=	46.74	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.63	x	0.7	=	56.79	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.63	x	0.7	=	34.08	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)

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West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	177.73	301.62	408.39	496.61	546.06	537.21	520	484.13	439.26	332.33	212.71	152.19	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	578.36	700.26	794.3	861.99	890.64	861.68	831.36	801.24	766.86	680.67	584.88	542.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.79	0.61	0.45	0.48	0.71	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.86	20.07	20.35	20.65	20.87	20.97	20.99	20.99	20.94	20.65	20.19	19.82	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.92	19.92	19.92	19.94	19.94	19.95	19.95	19.95	19.94	19.94	19.93	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.87	0.73	0.52	0.34	0.38	0.63	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.42	18.73	19.13	19.55	19.82	19.93	19.95	19.95	19.9	19.56	18.92	18.37	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19	19.27	19.62	19.99	20.24	20.35	20.37	20.37	20.32	20	19.43	18.95	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19	19.27	19.62	19.99	20.24	20.35	20.37	20.37	20.32	20	19.43	18.95	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.87	0.75	0.56	0.39	0.42	0.66	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	572.03	682.32	749.39	753.71	665.34	479.79	321.55	337.07	504.99	610.61	571.12	537.68	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1301.43	1269.17	1155.47	964.98	741.01	493.45	323.36	339.81	535.98	815.98	1075.38	1292.88	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	542.67	394.37	302.12	152.11	56.3	0	0	0	0	152.79	363.07	561.87	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2525.31 (98)

Space heating requirement in kWh/m²/year 34.26 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	542.67	394.37	302.12	152.11	56.3	0	0	0	0	152.79	363.07	561.87		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	580.4	421.78	323.13	162.68	60.22	0	0	0	0	163.41	388.31	600.93		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2700.86	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	192.77	169.93	178.52	160.11	156.95	140.32	134.84	147.86	147.57	166.02	175.45	188.16		
Efficiency of water heater													79.8	(216)
(217)m=	87.43	86.99	86.21	84.68	82.37	79.8	79.8	79.8	79.8	84.59	86.71	87.55		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	220.49	195.35	207.08	189.08	190.55	175.84	168.97	185.29	184.92	196.25	202.34	214.9		
Total = Sum(219a)$_{1...12}$ =													2331.06	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2700.86

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Water heating fuel used		2331.06	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		324.72	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	583.39	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	503.51	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1086.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	168.53	(268)
Total CO2, kg/year		sum of (265)…(271) =		1294.35	(272)

TER = 17.56 (273)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-9-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	92.81	(1a) x	2.4	(2a) =	222.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.81	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	222.74	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Windows Type 3			1.84	x1/[1/(1.2)+ 0.04]		=	2.11			(27)
Windows Type 4			4.6	x1/[1/(1.2)+ 0.04]		=	5.27			(27)
Windows Type 5			5.29	x1/[1/(1.2)+ 0.04]		=	6.06			(27)
Walls Type1	39.36	16.33	23.03	x	0.18	=	4.15			(29)
Walls Type2	23.43	2.1	21.33	x	0.18	=	3.84			(29)
Roof	51.52	0	51.52	x	0.11	=	5.67			(30)
Total area of elements, m²			114.31							(31)
Party wall			43.2	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	34.87	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		16.47	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	51.34	(37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.1	88.1	88.1	88.1	88.1	88.1	88.1	88.1	88.1	88.1	88.1	88.1	

Average = Sum(39)$_{1…12}$ /12= 88.1 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	

Average = Sum(40)$_{1…12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.66 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	107.17	103.27	99.38	95.48	91.58	87.69	87.69	91.58	95.48	99.38	103.27	107.17	

Total = Sum(44)$_{1…12}$ = 1169.14 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.93	139	143.44	125.05	119.99	103.54	95.95	110.1	111.42	129.85	141.74	153.92	

Total = Sum(45)$_{1…12}$ = 1532.93 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.84	20.85	21.52	18.76	18	15.53	14.39	16.52	16.71	19.48	21.26	23.09	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	214.21	188.93	198.72	178.55	175.27	157.04	151.23	165.38	164.91	185.12	195.23	209.19	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	214.21	188.93	198.72	178.55	175.27	157.04	151.23	165.38	164.91	185.12	195.23	209.19

Output from water heater (annual)$_{1...12}$ — 2183.77 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	97.07	86.16	91.91	84.38	84.12	77.22	76.12	80.83	79.84	87.4	89.92	95.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	21.91	19.46	15.82	11.98	8.96	7.56	8.17	10.62	14.25	18.1	21.12	22.52	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	244.15	246.69	240.3	226.71	209.55	193.43	182.66	180.12	186.51	200.1	217.26	233.38	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	(71)
Water heating gains (Table 5)													
(72)m=	130.47	128.22	123.54	117.19	113.06	107.25	102.32	108.64	110.89	117.47	124.89	128.22	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	459.46	457.29	442.6	418.81	394.51	371.18	356.08	362.32	374.58	398.6	426.2	447.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	4.6	x	10.63	x	0.5	x	0.8	=	13.56	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.5	x	0.8	=	25.91	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	4.6	x	34.53	x	0.5	x	0.8	=	44.03	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.5	x	0.8	=	70.72	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.5	x	0.8	=	95.27	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.5	x	0.8	=	101.99	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.5	x	0.8	=	95.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.5	x	0.8	=	75.55	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.5	x	0.8	=	52.94	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.5	x	0.8	=	30.84	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.5	x	0.8	=	16.73	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.5	x	0.8	=	11.3	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)

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West	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.23	132.37	220.45	333.22	423.85	441.92	417.35	347.25	259.5	157.25	84.75	56.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	527.69	589.67	663.05	752.03	818.36	813.1	773.42	709.57	634.08	555.85	510.96	503.44	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.86	0.67	0.5	0.56	0.84	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.01	20.13	20.35	20.64	20.87	20.98	21	20.99	20.92	20.61	20.25	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.94	0.81	0.59	0.4	0.46	0.77	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.79	18.97	19.29	19.7	20	20.11	20.12	20.12	20.06	19.66	19.14	18.74	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.28	19.43	19.71	20.07	20.35	20.46	20.47	20.47	20.4	20.04	19.59	19.23	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.28	19.43	19.71	20.07	20.35	20.46	20.47	20.47	20.4	20.04	19.59	19.23	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.82	0.62	0.44	0.5	0.79	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	526.24	586.31	652.37	708.75	673.14	502.38	339.66	355.39	502.42	537.44	507.92	502.38	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1319.5	1280.06	1163.76	984.26	762.2	516	341.22	358.64	555.27	831.74	1099.9	1324.43	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	590.19	466.2	380.47	198.37	66.26	0	0	0	0	218.96	426.22	611.61	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2958.28 (98)

Space heating requirement in kWh/m²/year 31.87 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2958.28	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	2329.65	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	776.55	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		2183.77	
If DHW from community scheme:			
Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1719.72	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	573.24	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	53.99	(313)

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Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		60.06	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	60.06	(331)
Energy for lighting (calculated in Appendix L)		386.9	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
Space heating from CHP)	(307a) × 100 ÷ (362) =	6130.65	x	0.22		1324.22	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1961.81	x	0.52		-1018.18	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4525.58	x	0.22		977.53	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1448.19	x	0.52		-751.61	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	313.5	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	28.02	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	873.48	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					873.48	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	31.17	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	200.8	(379)
Total CO2, kg/year	sum of (376)…(382) =					1105.45	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					11.91	(384)
EI rating (section 14)						89.25	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.8

Property Address: b2-9-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	92.81	(1a) x	2.4	(2a) =	222.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.81	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	222.74	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.38	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Windows Type 3			1.84	x1/[1/(1.4)+ 0.04]		=	2.44			(27)
Windows Type 4			4.6	x1/[1/(1.4)+ 0.04]		=	6.1			(27)
Windows Type 5			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Walls Type1	39.36	16.33	23.03	x	0.18	=	4.15			(29)
Walls Type2	23.43	2.1	21.33	x	0.18	=	3.84			(29)
Roof	51.52	0	51.52	x	0.13	=	6.7			(30)
Total area of elements, m²			114.31							(31)
Party wall			43.2	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.43 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 16.06 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 54.49 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	43.14	42.89	42.65	41.51	41.29	40.3	40.3	40.11	40.68	41.29	41.73	42.18	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	97.63	97.39	97.14	96	95.79	94.79	94.79	94.61	95.18	95.79	96.22	96.67	

Average = Sum(39)$_{1\ldots12}$ /12= 96 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.05	1.05	1.05	1.03	1.03	1.02	1.02	1.02	1.03	1.03	1.04	1.04	

Average = Sum(40)$_{1\ldots12}$ /12= 1.03 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.66 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	107.17	103.27	99.38	95.48	91.58	87.69	87.69	91.58	95.48	99.38	103.27	107.17	

Total = Sum(44)$_{1\ldots12}$ = 1169.14 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.93	139	143.44	125.05	119.99	103.54	95.95	110.1	111.42	129.85	141.74	153.92	

Total = Sum(45)$_{1\ldots12}$ = 1532.93 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.84	20.85	21.52	18.76	18	15.53	14.39	16.52	16.71	19.48	21.26	23.09	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.53	181.09	190.03	170.15	166.59	148.64	142.54	156.7	156.51	176.44	186.83	200.51	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.53	181.09	190.03	170.15	166.59	148.64	142.54	156.7	156.51	176.44	186.83	200.51

Output from water heater (annual)$_{1\ldots12}$ — 2081.55 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.12	79.89	84.97	77.65	77.17	70.5	69.18	73.88	73.12	80.45	83.2	88.45	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.31	19.82	16.12	12.2	9.12	7.7	8.32	10.82	14.52	18.43	21.51	22.93	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	244.15	246.69	240.3	226.71	209.55	193.43	182.66	180.12	186.51	200.1	217.26	233.38	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	(71)

Water heating gains (Table 5)

(72)m=	121.13	118.88	114.21	107.85	103.73	97.92	92.98	99.31	101.56	108.13	115.56	118.89	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	453.53	451.32	436.56	412.7	388.34	364.98	349.89	356.18	368.51	392.6	420.26	441.14	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	1.84	x	10.63	x	0.63	x	0.7	=	5.98	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.63	x	0.7	=	5.98	(74)
North	0.9x	0.77	x	4.6	x	10.63	x	0.63	x	0.7	=	14.95	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.63	x	0.7	=	11.43	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.63	x	0.7	=	11.43	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.63	x	0.7	=	28.57	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.63	x	0.7	=	19.42	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.63	x	0.7	=	19.42	(74)
North	0.9x	0.77	x	4.6	x	34.53	x	0.63	x	0.7	=	48.54	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.63	x	0.7	=	31.19	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.63	x	0.7	=	31.19	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.63	x	0.7	=	77.97	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.63	x	0.7	=	42.01	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.63	x	0.7	=	42.01	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.63	x	0.7	=	105.04	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.63	x	0.7	=	44.98	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.63	x	0.7	=	44.98	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.63	x	0.7	=	112.44	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.63	x	0.7	=	41.99	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.63	x	0.7	=	41.99	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.63	x	0.7	=	104.98	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.63	x	0.7	=	33.32	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.63	x	0.7	=	33.32	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.63	x	0.7	=	83.29	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.63	x	0.7	=	23.35	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.63	x	0.7	=	23.35	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.63	x	0.7	=	58.36	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.63	x	0.7	=	13.6	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.63	x	0.7	=	13.6	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.63	x	0.7	=	34.01	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.63	x	0.7	=	7.38	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.63	x	0.7	=	7.38	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.63	x	0.7	=	18.44	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.63	x	0.7	=	4.98	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.63	x	0.7	=	4.98	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.63	x	0.7	=	12.46	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	5.29	x	19.64	x	0.63	x	0.7	=	31.75	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.63	x	0.7	=	62.11	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)

West	0.9x	0.77	x	5.29	x	63.27	x	0.63	x	0.7	=	102.29	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.63	x	0.7	=	149.19	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.63	x	0.7	=	182.84	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.63	x	0.7	=	187.17	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.63	x	0.7	=	178.19	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.63	x	0.7	=	153.06	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.63	x	0.7	=	118.97	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.63	x	0.7	=	73.7	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.63	x	0.7	=	39.59	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.63	x	0.7	=	26.11	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	75.23	145.94	243.04	367.38	467.3	487.22	460.12	382.84	286.1	173.37	93.44	62.17	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	528.76	597.26	679.6	780.08	855.63	852.2	810.02	739.02	654.61	565.97	513.7	503.3	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.86	0.68	0.51	0.58	0.85	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.86	20	20.24	20.57	20.84	20.97	20.99	20.99	20.89	20.54	20.15	19.84	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.04	20.04	20.04	20.05	20.06	20.07	20.07	20.07	20.06	20.06	20.05	20.05	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.95	0.82	0.59	0.4	0.47	0.78	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.52	18.71	19.07	19.55	19.9	20.05	20.06	20.06	19.98	19.52	18.94	18.49	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.06	19.23	19.54	19.96	20.28	20.41	20.44	20.43	20.34	19.93	19.42	19.03	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(93)m=	19.06	19.23	19.54	19.96	20.28	20.41	20.44	20.43	20.34	19.93	19.42	19.03		(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	1	0.99	0.98	0.94	0.83	0.63	0.45	0.51	0.8	0.97	0.99	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	527.26	593.79	668.64	735.79	708.61	532.64	361.22	376.82	525.5	548.09	510.68	502.21		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	1440.69	1395.26	1266.57	1061.68	821.66	551.19	363.62	381.62	594.23	893.42	1185.73	1433.85		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	679.59	538.59	444.86	234.64	84.11	0	0	0	0	256.93	486.03	693.14		
Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =													3417.89	(98)
Space heating requirement in kWh/m²/year													36.83	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	679.59	538.59	444.86	234.64	84.11	0	0	0	0	256.93	486.03	693.14		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	726.83	576.03	475.79	250.95	89.95	0	0	0	0	274.79	519.82	741.32		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3655.5	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)														
	205.53	181.09	190.03	170.15	166.59	148.64	142.54	156.7	156.51	176.44	186.83	200.51		
Efficiency of water heater													79.8	(216)
(217)m=	87.77	87.55	87.01	85.67	83.1	79.8	79.8	79.8	79.8	85.82	87.25	87.86		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	234.17	206.85	218.41	198.6	200.47	186.26	178.63	196.36	196.13	205.61	214.13	228.23		
Total = Sum(219a)$_{1...12}$ =													2463.84	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3655.5

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Water heating fuel used			2463.84	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			394.08	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	789.59	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	532.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1321.78	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	204.53	(268)
Total CO2, kg/year			sum of (265)…(271) =		1565.23	(272)
TER =					16.86	(273)

BE GREEN

Note - As the calculation is area-weighted, all PV was loaded onto one dwelling for the purposes of determining the site reduction. This is accepted practice and correct, and negates 6-7 hours of data entry. Therefore, all results are Per the 'BE CLEAN' case, with the exception of the following dwelling

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.8

Property Address: Dwelling- 1

Address : Preliminary Planning SAPs

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	73.51	(1a)	x	2.4	(2a)	=	176.42	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.51	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	176.42	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.2	=	2.268			(26)
Windows Type 1			2.7	x1/[1/(1.2)+ 0.04]		=	3.09			(27)
Windows Type 2			5.63	x1/[1/(1.2)+ 0.04]		=	6.45			(27)
Windows Type 3			2.7	x1/[1/(1.2)+ 0.04]		=	3.09			(27)
Windows Type 4			2.7	x1/[1/(1.2)+ 0.04]		=	3.09			(27)
Windows Type 5			2.7	x1/[1/(1.2)+ 0.04]		=	3.09			(27)
Floor			73.51	x	0.11	=	8.086101			(28)
Walls Type1	40.8	16.43	24.37	x	0.18	=	4.39			(29)
Walls Type2	15.96	1.89	14.07	x	0.18	=	2.53			(29)
Total area of elements, m²			130.27							(31)
Party wall			33.48	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 36.09 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9350.14 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.74 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 45.83 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	29.11	29.11	29.11	29.11	29.11	29.11	29.11	29.11	29.11	29.11	29.11	29.11		(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	74.94	74.94	74.94	74.94	74.94	74.94	74.94	74.94	74.94	74.94	74.94	74.94		
Average = Sum(39)$_{1...12}$ /12=													74.94	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02		
Average = Sum(40)$_{1...12}$ /12=													1.02	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.5 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(44)m=	98.45	94.87	91.29	87.71	84.13	80.55	80.55	84.13	87.71	91.29	94.87	98.45		
Total = Sum(44)$_{1...12}$ =													1073.95	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.99	127.69	131.76	114.87	110.22	95.11	88.14	101.14	102.35	119.27	130.2	141.38		
Total = Sum(45)$_{1...12}$ =													1408.12	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.9	19.15	19.76	17.23	16.53	14.27	13.22	15.17	15.35	17.89	19.53	21.21	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.27	177.61	187.04	168.36	165.5	148.61	143.41	156.41	155.84	174.55	183.69	196.66	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.27	177.61	187.04	168.36	165.5	148.61	143.41	156.41	155.84	174.55	183.69	196.66

Output from water heater (annual)1…12 | 2058.95 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.76	82.4	88.03	80.99	80.87	74.42	73.53	77.85	76.82	83.88	86.09	91.23	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.41	116.41	116.41	116.41	116.41	116.41	116.41	116.41	116.41	116.41	116.41	116.41	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	18.31	16.26	13.22	10.01	7.48	6.32	6.83	8.87	11.91	15.12	17.65	18.82	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	205.35	207.48	202.11	190.68	176.25	162.68	153.62	151.49	156.86	168.29	182.72	196.29	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-93.13	-93.13	-93.13	-93.13	-93.13	-93.13	-93.13	-93.13	-93.13	-93.13	-93.13	-93.13	(71)
Water heating gains (Table 5)													
(72)m=	124.68	122.61	118.32	112.49	108.7	103.36	98.83	104.64	106.7	112.74	119.56	122.62	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	406.26	404.28	391.58	371.1	350.35	330.29	317.2	322.93	333.4	354.08	377.86	395.65	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	2.7	x	10.63	x	0.5	x	0.8	=	7.96	(74)
North	0.9x	0.77	x	5.63	x	10.63	x	0.5	x	0.8	=	16.59	(74)
North	0.9x	0.77	x	2.7	x	10.63	x	0.5	x	0.8	=	7.96	(74)
North	0.9x	0.77	x	2.7	x	20.32	x	0.5	x	0.8	=	15.21	(74)
North	0.9x	0.77	x	5.63	x	20.32	x	0.5	x	0.8	=	31.71	(74)
North	0.9x	0.77	x	2.7	x	20.32	x	0.5	x	0.8	=	15.21	(74)
North	0.9x	0.77	x	2.7	x	34.53	x	0.5	x	0.8	=	25.84	(74)
North	0.9x	0.77	x	5.63	x	34.53	x	0.5	x	0.8	=	53.89	(74)
North	0.9x	0.77	x	2.7	x	34.53	x	0.5	x	0.8	=	25.84	(74)
North	0.9x	0.77	x	2.7	x	55.46	x	0.5	x	0.8	=	41.51	(74)
North	0.9x	0.77	x	5.63	x	55.46	x	0.5	x	0.8	=	86.56	(74)
North	0.9x	0.77	x	2.7	x	55.46	x	0.5	x	0.8	=	41.51	(74)
North	0.9x	0.77	x	2.7	x	74.72	x	0.5	x	0.8	=	55.92	(74)
North	0.9x	0.77	x	5.63	x	74.72	x	0.5	x	0.8	=	116.6	(74)
North	0.9x	0.77	x	2.7	x	74.72	x	0.5	x	0.8	=	55.92	(74)
North	0.9x	0.77	x	2.7	x	79.99	x	0.5	x	0.8	=	59.86	(74)
North	0.9x	0.77	x	5.63	x	79.99	x	0.5	x	0.8	=	124.83	(74)
North	0.9x	0.77	x	2.7	x	79.99	x	0.5	x	0.8	=	59.86	(74)
North	0.9x	0.77	x	2.7	x	74.68	x	0.5	x	0.8	=	55.89	(74)
North	0.9x	0.77	x	5.63	x	74.68	x	0.5	x	0.8	=	116.54	(74)
North	0.9x	0.77	x	2.7	x	74.68	x	0.5	x	0.8	=	55.89	(74)
North	0.9x	0.77	x	2.7	x	59.25	x	0.5	x	0.8	=	44.34	(74)
North	0.9x	0.77	x	5.63	x	59.25	x	0.5	x	0.8	=	92.46	(74)
North	0.9x	0.77	x	2.7	x	59.25	x	0.5	x	0.8	=	44.34	(74)
North	0.9x	0.77	x	2.7	x	41.52	x	0.5	x	0.8	=	31.07	(74)
North	0.9x	0.77	x	5.63	x	41.52	x	0.5	x	0.8	=	64.79	(74)
North	0.9x	0.77	x	2.7	x	41.52	x	0.5	x	0.8	=	31.07	(74)
North	0.9x	0.77	x	2.7	x	24.19	x	0.5	x	0.8	=	18.1	(74)
North	0.9x	0.77	x	5.63	x	24.19	x	0.5	x	0.8	=	37.75	(74)
North	0.9x	0.77	x	2.7	x	24.19	x	0.5	x	0.8	=	18.1	(74)
North	0.9x	0.77	x	2.7	x	13.12	x	0.5	x	0.8	=	9.82	(74)
North	0.9x	0.77	x	5.63	x	13.12	x	0.5	x	0.8	=	20.47	(74)
North	0.9x	0.77	x	2.7	x	13.12	x	0.5	x	0.8	=	9.82	(74)
North	0.9x	0.77	x	2.7	x	8.86	x	0.5	x	0.8	=	6.63	(74)
North	0.9x	0.77	x	5.63	x	8.86	x	0.5	x	0.8	=	13.83	(74)
North	0.9x	0.77	x	2.7	x	8.86	x	0.5	x	0.8	=	6.63	(74)
East	0.9x	1	x	2.7	x	19.64	x	0.5	x	0.8	=	14.7	(76)
East	0.9x	1	x	2.7	x	19.64	x	0.5	x	0.8	=	14.7	(76)
East	0.9x	1	x	2.7	x	38.42	x	0.5	x	0.8	=	28.76	(76)
East	0.9x	1	x	2.7	x	38.42	x	0.5	x	0.8	=	28.76	(76)
East	0.9x	1	x	2.7	x	63.27	x	0.5	x	0.8	=	47.36	(76)

East	0.9x	1	x	2.7	x	63.27	x	0.5	x	0.8	=	47.36	(76)
East	0.9x	1	x	2.7	x	92.28	x	0.5	x	0.8	=	69.07	(76)
East	0.9x	1	x	2.7	x	92.28	x	0.5	x	0.8	=	69.07	(76)
East	0.9x	1	x	2.7	x	113.09	x	0.5	x	0.8	=	84.64	(76)
East	0.9x	1	x	2.7	x	113.09	x	0.5	x	0.8	=	84.64	(76)
East	0.9x	1	x	2.7	x	115.77	x	0.5	x	0.8	=	86.65	(76)
East	0.9x	1	x	2.7	x	115.77	x	0.5	x	0.8	=	86.65	(76)
East	0.9x	1	x	2.7	x	110.22	x	0.5	x	0.8	=	82.49	(76)
East	0.9x	1	x	2.7	x	110.22	x	0.5	x	0.8	=	82.49	(76)
East	0.9x	1	x	2.7	x	94.68	x	0.5	x	0.8	=	70.86	(76)
East	0.9x	1	x	2.7	x	94.68	x	0.5	x	0.8	=	70.86	(76)
East	0.9x	1	x	2.7	x	73.59	x	0.5	x	0.8	=	55.08	(76)
East	0.9x	1	x	2.7	x	73.59	x	0.5	x	0.8	=	55.08	(76)
East	0.9x	1	x	2.7	x	45.59	x	0.5	x	0.8	=	34.12	(76)
East	0.9x	1	x	2.7	x	45.59	x	0.5	x	0.8	=	34.12	(76)
East	0.9x	1	x	2.7	x	24.49	x	0.5	x	0.8	=	18.33	(76)
East	0.9x	1	x	2.7	x	24.49	x	0.5	x	0.8	=	18.33	(76)
East	0.9x	1	x	2.7	x	16.15	x	0.5	x	0.8	=	12.09	(76)
East	0.9x	1	x	2.7	x	16.15	x	0.5	x	0.8	=	12.09	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	61.91	119.64	200.29	307.72	397.73	417.85	393.31	322.86	237.09	142.2	76.76	51.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	468.17	523.92	591.87	678.81	748.08	748.14	710.51	645.79	570.49	496.28	454.63	446.93	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.82	0.62	0.46	0.53	0.8	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.1	20.34	20.65	20.89	20.98	21	20.99	20.92	20.61	20.23	19.94	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.76	0.54	0.36	0.42	0.73	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.7	18.89	19.23	19.66	19.96	20.05	20.07	20.06	20.01	19.61	19.07	18.64	(90)

fLA = Living area ÷ (4) = | 0.35 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.14	19.31	19.62	20.01	20.28	20.38	20.39	20.39	20.33	19.96	19.47	19.1	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.14	19.31	19.62	20.01	20.28	20.38	20.39	20.39	20.33	19.96	19.47	19.1	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.92	0.78	0.57	0.4	0.46	0.75	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	465.92	518.98	577.17	623.88	581.06	423.94	283.08	296.71	428.51	472.49	450.12	445.24	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1112.34	1079.97	983.01	832.32	643.31	433.01	284.15	298.98	466.67	701.64	927.35	1116.22	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	480.93	376.99	301.94	150.07	46.31	0	0	0	0	170.48	343.6	499.2	

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2369.54	(98)
Space heating requirement in kWh/m²/year		32.23	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community CHP		0.75	(303a)
Fraction of community heat from heat source 2		0.25	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.75	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.25	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2369.54	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1866.01	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	622	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2058.95	
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1621.43	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	540.48	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	46.5	(313)

DER WorkSheet: New dwelling design stage

Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.57	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	47.57	(331)
Energy for lighting (calculated in Appendix L)		323.3	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-36503.65	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit						32	(361)
Heat efficiency of CHP unit						38	(362)
		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	4910.55	x	0.22		1060.68	(363)
less credit emissions for electricity	–(307a) × (361) ÷ (362) =	1571.38	x	0.52		-815.54	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	4266.91	x	0.22		921.65	(365)
less credit emissions for electricity	–(310a) × (361) ÷ (362) =	1365.41	x	0.52		-708.65	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					93	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x			0.22	=	270	(368)
Electrical energy for heat distribution	[(313) x			0.52	=	24.13	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	752.27	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					752.27	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	24.69	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	167.79	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1				0.52	x 0.01 =	-18945.4	(380)
Total CO2, kg/year	sum of (376)…(382) =					-18000.65	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					-244.87	(384)
EI rating (section 14)						303.53	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.8

Property Address: Dwelling- 1

Address : Preliminary Planning SAPs

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.51	(1a) x	2.4	(2a) =	176.42	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.51	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.42	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			2.7	x1/[1/(1.4)+ 0.04]		=	3.58			(27)
Windows Type 2			5.63	x1/[1/(1.4)+ 0.04]		=	7.46			(27)
Windows Type 3			2.7	x1/[1/(1.4)+ 0.04]		=	3.58			(27)
Windows Type 4			2.7	x1/[1/(1.4)+ 0.04]		=	3.58			(27)
Windows Type 5			2.7	x1/[1/(1.4)+ 0.04]		=	3.58			(27)
Floor			73.51	x	0.13	=	9.5563			(28)
Walls Type1	40.8	16.43	24.37	x	0.18	=	4.39			(29)
Walls Type2	15.96	1.89	14.07	x	0.18	=	2.53			(29)
Total area of elements, m²			130.27							(31)
Party wall			33.48	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.15 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9350.14 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.92 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 46.06 (37)

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Ventilation heat loss calculated monthly — (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.14	34.91	34.68	33.6	33.4	32.46	32.46	32.29	32.82	33.4	33.81	34.23	(38)

Heat transfer coefficient, W/K — (39)m = (37) + (38)m

(39)m=	81.21	80.97	80.74	79.66	79.46	78.52	78.52	78.35	78.89	79.46	79.87	80.3	

Average = Sum(39)$_{1...12}$ /12= 79.66 (39)

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	1.1	1.1	1.1	1.08	1.08	1.07	1.07	1.07	1.07	1.08	1.09	1.09	

Average = Sum(40)$_{1...12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.33 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 89.5 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	98.45	94.87	91.29	87.71	84.13	80.55	80.55	84.13	87.71	91.29	94.87	98.45	

Total = Sum(44)$_{1...12}$ = 1073.95 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.99	127.69	131.76	114.87	110.22	95.11	88.14	101.14	102.35	119.27	130.2	141.38	

Total = Sum(45)$_{1...12}$ = 1408.12 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.9	19.15	19.76	17.23	16.53	14.27	13.22	15.17	15.35	17.89	19.53	21.21	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.39 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) — 0.75 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	192.59	169.77	178.35	159.96	156.82	140.2	134.73	147.73	147.44	165.87	175.29	187.98	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	192.59	169.77	178.35	159.96	156.82	140.2	134.73	147.73	147.44	165.87	175.29	187.98

Output from water heater (annual)$_{1...12}$ — 1956.73 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.82	76.12	81.09	74.27	73.92	67.7	66.58	70.9	70.1	76.93	79.36	84.29	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.41	116.41	116.41	116.41	116.41	116.41	116.41	116.41	116.41	116.41	116.41	116.41	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.31	16.26	13.22	10.01	7.48	6.32	6.83	8.87	11.91	15.12	17.65	18.81	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.35	207.48	202.11	190.68	176.25	162.68	153.62	151.49	156.86	168.29	182.72	196.29	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.13	-93.13	-93.13	-93.13	-93.13	-93.13	-93.13	-93.13	-93.13	-93.13	-93.13	-93.13	(71)

Water heating gains (Table 5)

(72)m=	115.35	113.28	108.99	103.15	99.36	94.03	89.49	95.3	97.37	103.41	110.23	113.29	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	399.92	397.94	385.24	364.76	344.01	323.95	310.86	316.59	327.06	347.75	371.52	389.31	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	2.7	x	10.63	x	0.63	x	0.7	=	8.77	(74)
North	0.9x	0.77	x	5.63	x	10.63	x	0.63	x	0.7	=	18.3	(74)
North	0.9x	0.77	x	2.7	x	10.63	x	0.63	x	0.7	=	8.77	(74)
North	0.9x	0.77	x	2.7	x	20.32	x	0.63	x	0.7	=	16.77	(74)
North	0.9x	0.77	x	5.63	x	20.32	x	0.63	x	0.7	=	34.96	(74)
North	0.9x	0.77	x	2.7	x	20.32	x	0.63	x	0.7	=	16.77	(74)
North	0.9x	0.77	x	2.7	x	34.53	x	0.63	x	0.7	=	28.49	(74)
North	0.9x	0.77	x	5.63	x	34.53	x	0.63	x	0.7	=	59.41	(74)
North	0.9x	0.77	x	2.7	x	34.53	x	0.63	x	0.7	=	28.49	(74)
North	0.9x	0.77	x	2.7	x	55.46	x	0.63	x	0.7	=	45.77	(74)
North	0.9x	0.77	x	5.63	x	55.46	x	0.63	x	0.7	=	95.43	(74)
North	0.9x	0.77	x	2.7	x	55.46	x	0.63	x	0.7	=	45.77	(74)
North	0.9x	0.77	x	2.7	x	74.72	x	0.63	x	0.7	=	61.65	(74)
North	0.9x	0.77	x	5.63	x	74.72	x	0.63	x	0.7	=	128.56	(74)
North	0.9x	0.77	x	2.7	x	74.72	x	0.63	x	0.7	=	61.65	(74)
North	0.9x	0.77	x	2.7	x	79.99	x	0.63	x	0.7	=	66	(74)
North	0.9x	0.77	x	5.63	x	79.99	x	0.63	x	0.7	=	137.62	(74)
North	0.9x	0.77	x	2.7	x	79.99	x	0.63	x	0.7	=	66	(74)
North	0.9x	0.77	x	2.7	x	74.68	x	0.63	x	0.7	=	61.62	(74)
North	0.9x	0.77	x	5.63	x	74.68	x	0.63	x	0.7	=	128.49	(74)
North	0.9x	0.77	x	2.7	x	74.68	x	0.63	x	0.7	=	61.62	(74)
North	0.9x	0.77	x	2.7	x	59.25	x	0.63	x	0.7	=	48.89	(74)
North	0.9x	0.77	x	5.63	x	59.25	x	0.63	x	0.7	=	101.94	(74)
North	0.9x	0.77	x	2.7	x	59.25	x	0.63	x	0.7	=	48.89	(74)
North	0.9x	0.77	x	2.7	x	41.52	x	0.63	x	0.7	=	34.26	(74)
North	0.9x	0.77	x	5.63	x	41.52	x	0.63	x	0.7	=	71.43	(74)
North	0.9x	0.77	x	2.7	x	41.52	x	0.63	x	0.7	=	34.26	(74)
North	0.9x	0.77	x	2.7	x	24.19	x	0.63	x	0.7	=	19.96	(74)
North	0.9x	0.77	x	5.63	x	24.19	x	0.63	x	0.7	=	41.62	(74)
North	0.9x	0.77	x	2.7	x	24.19	x	0.63	x	0.7	=	19.96	(74)
North	0.9x	0.77	x	2.7	x	13.12	x	0.63	x	0.7	=	10.82	(74)
North	0.9x	0.77	x	5.63	x	13.12	x	0.63	x	0.7	=	22.57	(74)
North	0.9x	0.77	x	2.7	x	13.12	x	0.63	x	0.7	=	10.82	(74)
North	0.9x	0.77	x	2.7	x	8.86	x	0.63	x	0.7	=	7.31	(74)
North	0.9x	0.77	x	5.63	x	8.86	x	0.63	x	0.7	=	15.25	(74)
North	0.9x	0.77	x	2.7	x	8.86	x	0.63	x	0.7	=	7.31	(74)
East	0.9x	1	x	2.7	x	19.64	x	0.63	x	0.7	=	16.21	(76)
East	0.9x	1	x	2.7	x	19.64	x	0.63	x	0.7	=	16.21	(76)
East	0.9x	1	x	2.7	x	38.42	x	0.63	x	0.7	=	31.7	(76)
East	0.9x	1	x	2.7	x	38.42	x	0.63	x	0.7	=	31.7	(76)
East	0.9x	1	x	2.7	x	63.27	x	0.63	x	0.7	=	52.21	(76)

TER WorkSheet: New dwelling design stage

East	0.9x	1	x	2.7	x	63.27	x	0.63	x	0.7	=	52.21	(76)
East	0.9x	1	x	2.7	x	92.28	x	0.63	x	0.7	=	76.15	(76)
East	0.9x	1	x	2.7	x	92.28	x	0.63	x	0.7	=	76.15	(76)
East	0.9x	1	x	2.7	x	113.09	x	0.63	x	0.7	=	93.32	(76)
East	0.9x	1	x	2.7	x	113.09	x	0.63	x	0.7	=	93.32	(76)
East	0.9x	1	x	2.7	x	115.77	x	0.63	x	0.7	=	95.53	(76)
East	0.9x	1	x	2.7	x	115.77	x	0.63	x	0.7	=	95.53	(76)
East	0.9x	1	x	2.7	x	110.22	x	0.63	x	0.7	=	90.95	(76)
East	0.9x	1	x	2.7	x	110.22	x	0.63	x	0.7	=	90.95	(76)
East	0.9x	1	x	2.7	x	94.68	x	0.63	x	0.7	=	78.12	(76)
East	0.9x	1	x	2.7	x	94.68	x	0.63	x	0.7	=	78.12	(76)
East	0.9x	1	x	2.7	x	73.59	x	0.63	x	0.7	=	60.72	(76)
East	0.9x	1	x	2.7	x	73.59	x	0.63	x	0.7	=	60.72	(76)
East	0.9x	1	x	2.7	x	45.59	x	0.63	x	0.7	=	37.62	(76)
East	0.9x	1	x	2.7	x	45.59	x	0.63	x	0.7	=	37.62	(76)
East	0.9x	1	x	2.7	x	24.49	x	0.63	x	0.7	=	20.21	(76)
East	0.9x	1	x	2.7	x	24.49	x	0.63	x	0.7	=	20.21	(76)
East	0.9x	1	x	2.7	x	16.15	x	0.63	x	0.7	=	13.33	(76)
East	0.9x	1	x	2.7	x	16.15	x	0.63	x	0.7	=	13.33	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.26	131.91	220.82	339.26	438.5	460.68	433.62	355.96	261.39	156.78	84.63	56.54	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	468.18	529.85	606.06	704.02	782.51	784.63	744.49	672.55	588.45	504.52	456.16	445.85	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.82	0.62	0.46	0.53	0.81	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.85	20	20.26	20.61	20.87	20.98	21	20.99	20.91	20.56	20.15	19.83	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20	20	20.01	20.02	20.03	20.03	20.03	20.02	20.02	20.01	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.76	0.53	0.36	0.42	0.73	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.47	18.68	19.06	19.56	19.89	20.01	20.03	20.03	19.95	19.51	18.92	18.45	(90)

fLA = Living area ÷ (4) = | 0.35 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.96	19.14	19.48	19.93	20.24	20.35	20.37	20.36	20.29	19.88	19.35	18.93	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.96	19.14	19.48	19.93	20.24	20.35	20.37	20.36	20.29	19.88	19.35	18.93	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.92	0.78	0.56	0.4	0.46	0.75	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	465.93	524.8	590.87	646.08	606.65	441.14	294.36	307.86	443.65	480.89	451.72	444.17	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1190.17	1153.41	1048.2	878.68	678.29	451.51	295.65	310.57	488.14	737.44	978.32	1182.98	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	538.83	422.42	340.25	167.47	53.3	0	0	0	0	190.87	379.15	549.68	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2641.97 (98)

Space heating requirement in kWh/m²/year 35.94 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	538.83	422.42	340.25	167.47	53.3	0	0	0	0	190.87	379.15	549.68		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	576.29	451.79	363.9	179.11	57.01	0	0	0	0	204.14	405.51	587.89		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2825.64	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	192.59	169.77	178.35	159.96	156.82	140.2	134.73	147.73	147.44	165.87	175.29	187.98		
Efficiency of water heater													79.8	(216)
(217)m=	87.41	87.15	86.51	84.94	82.27	79.8	79.8	79.8	79.8	85.19	86.82	87.51		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	220.32	194.8	206.16	188.33	190.62	175.7	168.84	185.13	184.76	194.71	201.9	214.81		
Total = Sum(219a)$_{1...12}$ =													2326.07	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2825.64

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Water heating fuel used			2326.07	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			323.29	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	610.34	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	502.43	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1112.77	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	167.79	(268)
Total CO2, kg/year		sum of (265)…(271) =		1319.48	(272)
TER =				17.95	(273)

Commercial Elements

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Osiers Road BE LEAN

As designed

Date: Tue Jul 17 10:36:18 2018

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.10

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.10

BRUKL compliance check version: v5.4.b.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: BBSe

Telephone number: 01892 891 280

Address: Teaselwood Barn, Lamberhurst Vineyard, Lamberhurst, TN3 8LA

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	18.3
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	18.3
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	14
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	FF000000:Surf[2]
Floor	0.25	0.11	0.11	FF000000:Surf[0]
Roof	0.25	0.11	0.11	FF000005:Surf[12]
Windows***, roof windows, and rooflights	2.2	1.6	1.6	FF000000:Surf[1]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- Be Lean

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	3.5	0	0	0.85
Standard value	0.91*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

"No HWS in project, or hot water is provided by HVAC system"

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Cafe	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Reception	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Offices	100	-	-	899
Offices	100	-	-	1432
Offices	100	-	-	287
Offices	100	-	-	267
Offices	100	-	-	267
Offices	100	-	-	114
Offices	100	-	-	215
Offices	100	-	-	215
Offices	100	-	-	777
Offices	100	-	-	279
Offices	100	-	-	7108
Offices	100	-	-	178
Cafe	-	100	-	537
Offices	100	-	-	1423
Reception	-	100	75	697
Offices	100	-	-	2784
Offices	100	-	-	2706

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Offices	NO (-11.8%)	NO
Offices	NO (-30.9%)	NO
Offices	NO (-39.9%)	NO
Offices	NO (-9.6%)	NO
Offices	NO (-29.1%)	NO
Offices	NO (-68.3%)	NO
Offices	NO (-49.4%)	NO
Offices	NO (-33%)	NO
Offices	NO (-68.8%)	NO
Offices	NO (-67.3%)	NO
Offices	NO (-56.6%)	NO
Offices	NO (-68.3%)	NO
Cafe	NO (-51.1%)	NO
Offices	NO (-65.1%)	NO
Reception	NO (-61%)	NO
Offices	NO (-32.1%)	NO
Offices	NO (-53.3%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	3649.3	3649.3
External area [m²]	3669.6	3669.6
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	2062.44	1426.87
Average U-value [W/m²K]	0.56	0.39
Alpha value* [%]	10	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	11.3	7.42
Cooling	6.09	5.62
Auxiliary	3.74	2.09
Lighting	9.72	22.22
Hot water	7.49	7.07
Equipment*	41.35	41.35
TOTAL**	**38.35**	**44.42**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	93.71	99.62
Primary energy* [kWh/m²]	81.46	107.26
Total emissions [kg/m²]	14	18.3

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	36.3	57.4	11.3	6.1	3.7	0.89	2.62	0.91	3.5
	Notional	0	0	0	0	0	0	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	23	76.6	7.4	5.6	2.1	0.86	3.79	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U_{i-Typ}	U_{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.18	FF000000:Surf[2]
Floor	0.2	0.11	FF000000:Surf[0]
Roof	0.15	0.11	FF000005:Surf[12]
Windows, roof windows, and rooflights	1.5	1.6	FF000000:Surf[1]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

U_{i-Typ} = Typical individual element U-values [W/(m²K)]

U_{i-Min} = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
$m^3/(h.m^2)$ at 50 Pa	5	5

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Osiers Commercial

As designed

Date: Tue Jul 17 13:53:18 2018

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.10

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.10

BRUKL compliance check version: v5.4.b.0

Owner Details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	17.9
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	17.9
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	11.5
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-Limit}}$	$U_{a\text{-Calc}}$	$U_{i\text{-Calc}}$	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	FF000000:Surf[2]
Floor	0.25	0.11	0.11	FF000000:Surf[0]
Roof	0.25	0.11	0.11	FF000005:Surf[12]
Windows***, roof windows, and rooflights	2.2	1.6	1.6	FF000000:Surf[1]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-Limit}}$ = Limiting area-weighted average U-values [W/(m²K)]

$U_{a\text{-Calc}}$ = Calculated area-weighted average U-values [W/(m²K)]

$U_{i\text{-Calc}}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- VRF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	5.5	0	0	0.85
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

"No HWS in project, or hot water is provided by HVAC system"

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Cafe	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Reception	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A
Offices	-	1	0	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Offices	100	-	-	899
Offices	100	-	-	1432
Offices	100	-	-	287
Offices	100	-	-	267
Offices	100	-	-	267
Offices	100	-	-	114
Offices	100	-	-	215
Offices	100	-	-	215
Offices	100	-	-	777
Offices	100	-	-	279
Offices	100	-	-	7108
Offices	100	-	-	178
Cafe	-	100	-	537
Offices	100	-	-	1423
Reception	-	100	75	697
Offices	100	-	-	2784
Offices	100	-	-	2706

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Offices	NO (-11.8%)	NO
Offices	NO (-30.9%)	NO
Offices	NO (-39.9%)	NO
Offices	NO (-9.6%)	NO
Offices	NO (-29.1%)	NO
Offices	NO (-68.3%)	NO
Offices	NO (-49.4%)	NO
Offices	NO (-33%)	NO
Offices	NO (-68.8%)	NO
Offices	NO (-67.3%)	NO
Offices	NO (-56.6%)	NO
Offices	NO (-68.3%)	NO
Cafe	NO (-51.1%)	NO
Offices	NO (-65.1%)	NO
Reception	NO (-61%)	NO
Offices	NO (-32.1%)	NO
Offices	NO (-53.3%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	3649.3	3649.3
External area [m²]	3669.6	3669.6
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	2062.44	1426.87
Average U-value [W/m²K]	0.56	0.39
Alpha value* [%]	10	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	2.29	2.5
Cooling	3.88	5.62
Auxiliary	3.74	2.09
Lighting	9.72	22.22
Hot water	7.49	7.07
Equipment*	41.35	41.35
TOTAL**	**27.11**	**39.5**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	93.71	99.62
Primary energy* [kWh/m²]	74.72	113.17
Total emissions [kg/m²]	11.5	17.9

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	36.3	57.4	2.3	3.9	3.7	4.41	4.11	4.5	5.5
	Notional	0	0	0	0	0	0	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	23	76.6	2.5	5.6	2.1	2.56	3.79	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.18	FF000000:Surf[2]
Floor	0.2	0.11	FF000000:Surf[0]
Roof	0.15	0.11	FF000005:Surf[12]
Windows, roof windows, and rooflights	1.5	1.6	FF000000:Surf[1]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
$m^3/(h.m^2)$ at 50 Pa	5	5