

GLA Energy Comments (24th Sept 2019) – Updated Design Response

9, 11 & 19 Osiers Road, Wandsworth, London

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Limited

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Introduction

The following document is aimed to address further comments raised by the GLA Sustainability Team on 24th September 2019 with regard to the development proposals at 9, 11 & 19 Osiers Road, Wandsworth, London.

The GLA commentary is noted in *italic* and the design response noted below.

Design Response

4. ***A Dynamic Overheating Analysis has been undertaken to assess the overheating risk within the dwellings using the CIBSE TM59 methodology and the London Design Summer Year 1 (DSY1) weather file: 2020s, High emission, 50% percentile scenario. The applicant should also investigate the risk of overheating using the DSY 2 & 3 weather files, and the full results from these scenarios should be presented. Consideration should be given for how occupants can reduce the risk of overheating in such conditions.***

The results show that the design proposals are anticipated to meet the CIBSE recommendations for comfort against DSY1, assuming natural ventilation i.e. occupants can open the windows, however, also requires internal blinds and mechanical ventilation, which is not encouraged. Therefore:

- The applicant should consider further passive design measures in line with Policy 5.9 (including reducing the glazing g-value and external shading), to reduce the reliance on blinds and mechanical ventilation and ensure all units pass the requirements with these features at a minimum.***
- The applicant should confirm that any required blinds will be included in the base build and demonstrate that the blinds do not interfere with the effective opening area of windows.***

Response: The requirement to assess the building to TM59, using DSY 2 & 3, is a requirement of the October 2018 guidance, which, was published after the Stage 2 design was complete and planning application was submitted. Within this guidance, it is understood that compliance with these additional weather files is not mandatory. In addition, the CIBSE TM59 guidance states, that these scenarios can be used to provide information on designs of particular concern, however, should not be considered applicable to the TM59 test.

Re-evaluating the model to account for these additional weather files would take considerable time, as this assessment was undertaken and report submitted over 14 months ago, and would need to be reviewed. It is expected that the results would show non-compliance in these scenarios, which as noted above is not relevant to the acceptability of the proposals in any case. It is therefore not considered necessary to revisit the thermal comfort assessment at this stage.

With regard to the evaluation of further measures, it is not considered suitable to further reduce the glazing g-value. The g-value was selected after considerable analysis in order to provide a compromise between heat loss, daylight provision, and overheating mitigation. Reducing this g-value further would significantly increase the SAP emissions, leading to potential non-compliance with the GLA's 'Be Lean' guidance (meeting the baseline emissions). In addition, daylight levels would suffer, reducing the quality of accommodation.

External shading is not considered feasible at this stage. The building appearance and façade are fixed, having gone through significant discussion with the local authority, local community groups, two independent design review panels and other stakeholders. No additional external shading would be feasible without impacting the design and appearance of the façade, which is not considered possible as it would require a significant re-consultation, and reassessment of the design and redesign of the building.

Therefore, internal blinds will be installed, and we confirm that this shall be part of the base-build specification. In addition, as detailed in the submitted reports, the home user guide shall contain advice to residents on keeping cool during hot weather. This would include advice such as keeping windows and blinds closed when in direct sunlight on a hot day, as well as the benefits of purging heat at night, and the benefits of keeping internal doors open on hot days to promote airflow throughout the property. In addition, there are other factors that residents can take advantage of to keep cool in the summer, such as adjusting clothing levels, the use of fans etc.

- 7. The applicant has reviewed their proposals and is now assuming a high performance thermally broken bolt-on balcony connectors, rather than a traditional cantilevered balcony junction. They suggest that the revised proposal significantly reduces thermal bridging, and that the revised Be Lean emissions are 198.5 tonnes/annum, which equates to a reduction of 7 tonnes per annum (~4%) in regulated CO₂ emissions compared to a 2013 Building Regulations compliant development. The applicant should provide evidence to demonstrate the improved performance of the balcony junction.**

The applicant has considered and ruled out MVHR due to spatial constraints with the current design, and they propose to consider the potential for improvements in U-values during the detailed design. They have provided a revised SAP block compliance sheet, but they should submit sample DER sheets.

Response: Cantilevered balconies are inherently thermally inefficient as the entire slab penetrates the insulation layer of the external envelope. This provides a significant thermal bridge along the length of the balcony. By contrast, 'bolt-on' balconies only penetrate the insulation at individual points, massively reducing the thermal bridge across the junction.

The current SAP protocols are to ignore the bridging effect of bolt on balconies, owing to their negligible effect on the thermal performance of the building. However, in order to more accurately reflect real world performance, and a worst-case scenario, we have still included a nominal psi value for this junction. The specific products used shall be subject to detailed design, as other factors, not just thermal performance, shall need to be considered when selecting the final product to be used. This will form part of the detailed design of the scheme and are not known or considered relevant at this stage.

Sample DER sheets are included in Appendix 1 as requested.

- 13. Given the scale of the development, and in line with the GLA guidance on preparing energy assessments, a CHP-led heating strategy is not considered appropriate for the proposed development. The applicant should consider the potential of other, more appropriate, low carbon/renewable technologies that could supply the heating requirements of the site.**

The applicant has undertaken a detailed feasibility analysis for heating options for the site. The applicant has reviewed the feasibility of Air Source Heat Pumps (ASHPs), including several potential approaches. Considerations the applicant cites include:

- ***the implementation of ASHPs would require a further application to UKPN, and an additional transformer.***
- ***Plant space would be required at roof level, with ~120m² required, plus ~1m² of riser space.***
- ***Noise needs to be considered and acoustic screening would be required, adding height to the building.***
- ***Worse carbon performance using SAP 2012 emissions factors.***
- ***Reduced PV area.***
- ***Potential impacts on the structural frame.***
- ***Planning related issues potentially including bulk and scale and daylight and sunlight impacts.***
- ***Time required to redesign the scheme.***

In response to these points, the applicant should:

- 1. Consider whether air source heat pumps could be accommodated in a louvred plant room and not on roofs.***

Response: Whilst it would be technically possible to accommodate air source heat pumps within a louvred plantroom, it is not considered feasible for a number of reasons set out below:

- a) The plant space required would be double height (inlet air at low level, outlet air at high level). This would be best positioned at ground level. Therefore, in this example, the louvred plant rooms would need to replace commercial floor area. One of the principle planning policy considerations is no net loss of employment floor area. The introduction of louvred plant rooms would result in the loss of employment floor area. This change would also result in the loss of 'active frontage' which again was considered by the Local Planning Authority to be important to the public realm.
- b) An alternative to a) would be losing residential accommodation at the top of the building to create a louvred plant area that sits within the current massing. The 100% affordable housing offer is on the basis of no loss of residential units.
- c) Noise. Air Source Heat Pumps at ground level would need acoustic treatment to mitigate impacts on adjacent spaces, e.g. flats above and public realm. Louvred openings to the plantroom would need acoustic treatment to deal with airborne noise and also create 'dead frontage'.
- d) Cold air discharge at ground level. Air Source Heat Pumps take heat from ambient air. In winter the leaving air will be very cold, circa -10deg to -15deg. Discharge of this air at street level would create nuisance, render part of the public realm unusable and risk of icing up pavements.

The a) – d) changes above would also require a complete redesign of the building which would take months to arrange which in turn would render the 100% affordable housing offer unviable for the reasons already explained.

- 2. Consider that they are welcome to use SAP 10 emissions factors, and in our experience when proposing heat pumps and using SAP 10 emissions factors, a similar or greater level of CO₂ savings can be achieved than with CHP and SAP 2012 emissions factors.***

Response: When the development was designed, and the planning application submitted it was not permitted to use any carbon factors other than those outlined within SAP2012, for the

purposes of conducting an energy assessment, despite the acknowledgement of potential inaccuracy within the energy planning guidance. See excerpt below from GLA Energy Planning Guidance 2016:

8.4 The carbon dioxide emissions factors used in the energy assessment must be those adopted for Part L 2013 of the Building Regulations, as set out in Table 12 of SAP2012. While it is recognised that the carbon factor from grid electricity may fluctuate significantly during the lifetime of the development, the approach adopted for energy assessments is to use the value which has been adopted within Building Regulations at the time of the application for planning permission.

Therefore, the scheme was designed, and submitted for planning on this basis, leading to the adoption of CHP technology, as encouraged and supported by GLA Policy up until the end of October 2018. Changes to this guidance that have been published after the planning application was submitted cannot be deemed reasonable to be enforced at such a late stage, and with such a fundamental impact on the building design. As stated in the guidance excerpt above, we are required to use the value adopted within the building regulations at the time of application for planning permission. This has been followed.

3. Outline the potential impacts of ASHPs on the structural frame in detail.

Response: We have undertaken an initial review of the impact on the structural design should you have to install the Mitsubishi ASHP products on the roof of block B2.

Proposals

It is understood that two ASHP units are required to service the development; these will be located on the roof of block B2 and are to be surrounded by a 3m high acoustic louver. Each of the units weights 2410kg and has a footprint of 4.11 x 2.22m. To support these units over the current roof build up will require a 200mm concrete plinth, this may be cast over rigid insulation but will likely be cast directly over the concrete slab.

Around the ASHP unit we have allowed for access and maintenance loading within the zone defined by the acoustic screening. This is an area shown on the roof sketch plan (sent with previous energy response on 16th Sept) as being 256m² on a roof of 310m². The acoustic screen is taken as a dense screen of circa 60kg/m² allowing for a 300mm width profile. It is to be 3.0m high.

Structural Impacts

The present design does not allow for plant loading on the roof. The current allowance is for a standard flat roof with access loads for maintenance of PV panels. The weight of the ASHP units is equivalent to 2.6kN/m², the plinth is 5kN/m² and we have allowed 1.5 kN/m² for distribution services; the total being 9.1kN/m² as an average force under the units. This plant loading is considerably heavier than the current allowance for the roofs. As such we estimate that the slab depth will increase from 250mm to 350mm reinforcement allowance should increase from 130 to 150kn/m³. Allow 90kg/m³ for the plinth.

A further impact of the plan is the heavy acoustic screen. These will add line loads of circa 3

to 4 kn/m around most of the perimeter of the roof. The louvres will need a supporting structural steel frame. This will be made from galvanised hot rolled structural steel sections, typically 203 uc sections with posts at 3.0m centres.

The building will have to be designed for the increase in effective height due to the screens. These will add 3m to the profile of the building increasing the height from approx. 45 to approx. 48m or about 6% increase in height which is equivalent to an increase in force on the shear walls and core foundations of 13%. It is likely that this will not significantly affect the overall size of the core walls, but a minor increase in reinforcement will be required and adjustment in specification of the piles which may impact on the structural grid running up the building.

4. Discuss in detail the planning related issues caused by the adoption of ASHPs with borough and GLA case officers; evidence of the correspondence should be submitted.

Response: Detailed responses have been provided previously regarding the planning discussions held with LB Wandsworth and local residents and the planning considerations related to the impact ASHP's would have on the current scheme. These are set out in previous correspondence submitted to the GLA.

15. The applicant has suggested that PV is currently proposed to all high-level roof space, and that the southern lower roofs could feasibly include PV however, this would impede the visual amenity for residents, and they are currently proposed as green roofs. The applicant should consider the potential for bio-solar to the southern lower roof.

The applicant has suggested that the current proposals meet the 35% overall target; however, applicants are also required to maximise PV and they should demonstrate that PV has been maximised.

They have provided an over-shading assessment, although it is unclear how much shading is present in each area. The applicant should submit a similar drawing which shows the solar insolation levels, so that the shading can be quantified.

Response:

The concern with this aspect is that it will negatively impact quality of visual amenity for residents. The response from the energy team has not acknowledged or addressed this concern. As demonstrated previously, PV has been maximised to all major roof spaces where its installation would not impact visual amenity. The lower roof area is small and will not provide a significant opportunity for PV's. Conversely it is the area which both residents of the development and adjoining residents will see most clearly and is likely to have a significant impact on visual amenity. Whilst Hollybrook is willing to consider options we consider this provision on balance is not necessary and will have a greater harm than benefit.

With regard to solar shading of the northern roof the roof in question is directly north of a taller section of the building. Whilst sun shall be available to some parts during high summer, owing to the sun-path being higher in the sky. Parts of the roof (in particular those nearer the upper parts of the building) shall be shaded for the majority of the year. Owing to how solar panels are connected in series, reduced output from one panel will reduce output from all connected panels. Therefore, PV/Bio-Solar is deemed less efficient and feasible to this roof space.

In addition, even if PV were feasible to this space, there is still the question of the impact of the quality of visual amenity for residents.

Appendix 1 – Sample DER Sheets

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: a1-2-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

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

2. Ventilation rate:

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

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

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

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

DER WorkSheet: New dwelling design stage

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

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

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

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

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

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 10.79 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 44.29 (37)

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

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

DER WorkSheet: New dwelling design stage

(38)m=

29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

73.97	73.97	73.97	73.97	73.97	73.97	73.97	73.97	73.97	73.97	73.97	73.97

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

73.97

 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99

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

0.99

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

if TFA ≤ 13.9, N = 1

2.36

 (42)

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

90.25

 (43)

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

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

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

(44)m=

99.27	95.66	92.05	88.44	84.83	81.22	81.22	84.83	88.44	92.05	95.66	99.27

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

1082.96

 (44)

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

(45)m=

147.22	128.76	132.87	115.83	111.15	95.91	88.88	101.99	103.2	120.27	131.29	142.57

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

1419.93

 (45)

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

(46)m=

22.08	19.31	19.93	17.38	16.67	14.39	13.33	15.3	15.48	18.04	19.69	21.39

 (46)

Water storage loss:

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

0

 (47)

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

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

Water storage loss:

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

0

 (48)

Temperature factor from Table 2b

0

 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110

 (50)

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

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

0.02

 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

 (52)

Temperature factor from Table 2b

0.6

 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03

 (54)

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

1.03

 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

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

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

DER WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

(61)

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

(62)m=

202.49	178.68	188.14	169.33	166.42	149.4	144.15	157.26	156.7	175.55	184.78	197.85

(62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=

202.49	178.68	188.14	169.33	166.42	149.4	144.15	157.26	156.7	175.55	184.78	197.85

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

2070.77

(64)

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

(65)m=

93.17	82.75	88.4	81.31	81.18	74.69	73.77	78.13	77.11	84.21	86.45	91.63

(65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99

(66)

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

(67)m=

18.61	16.53	13.44	10.17	7.61	6.42	6.94	9.02	12.1	15.37	17.94	19.12

(67)

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

(68)m=

208.54	210.71	205.25	193.64	178.99	165.22	156.01	153.85	159.3	170.91	185.57	199.34

(68)

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

(69)m=

34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8

(69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

(70)

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

(71)m=

-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39

(71)

Water heating gains (Table 5)

(72)m=

125.23	123.15	118.82	112.93	109.11	103.73	99.16	105.02	107.1	113.19	120.07	123.15

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

410.78	408.77	395.91	375.15	354.1	333.76	320.51	326.28	336.9	357.87	381.97	400.02

(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)			
North	0.9x	0.77	x		5.98	x	10.63	x	0.5	x	0.8	=	17.63	(74)
North	0.9x	0.77	x		2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)

DER WorkSheet: New dwelling design stage

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

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

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

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

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

7. Mean internal temperature (heating season)

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

21 (85)

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

(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	1	1	0.99	0.96	0.86	0.67	0.5	0.57	0.84	0.98	1	1	

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

(87)m=	20	20.11	20.32	20.61	20.86	20.97	21	20.99	20.91	20.6	20.24	19.96	(87)

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

(88)m=	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	(88)

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

(89)m=	1	0.99	0.98	0.94	0.81	0.59	0.4	0.46	0.77	0.96	0.99	1	(89)

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

(90)m=	18.75	18.91	19.22	19.64	19.96	20.08	20.09	20.09	20.02	19.62	19.11	18.7	(90)

fLA = Living area ÷ (4) =

0.4 (91)

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

(92)m=	19.25	19.39	19.66	20.03	20.32	20.44	20.45	20.45	20.38	20.01	19.56	19.21	(92)

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

(93)m=	19.25	19.39	19.66	20.03	20.32	20.44	20.45	20.45	20.38	20.01	19.56	19.21	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.94	0.82	0.62	0.44	0.5	0.79	0.96	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	457.87	499.33	544.48	585.95	558.46	418.97	283.51	296.43	416.84	452.3	438.96	439.24	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1105.82	1071.97	973.73	823.16	637.68	431.66	285.07	299.65	464.26	696.27	921.74	1110.02	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	482.07	384.82	319.36	170.79	58.94	0	0	0	0	181.52	347.6	499.06	

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2444.15 (98)

Space heating requirement in kWh/m²/year

32.61 (99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

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

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

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

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

2444.15

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

2566.36 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2070.77

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2174.31 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

47.41 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

48.49 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

48.49 (331)

Energy for lighting (calculated in Appendix L)

328.59 (332)

12b. CO2 Emissions – Community heating scheme

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%)

If there is CHP using two fuels repeat (363) to (366) for the second fuel

93 (367a)

CO2 associated with heat source 1

[(307b)+(310b)] x 100 ÷ (367b) x

0.22

=

1101.06 (367)

Electrical energy for heat distribution

[(313) x

0.52

=

24.6 (372)

Total CO2 associated with community systems

(363)...(366) + (368)...(372)

=

1125.66 (373)

CO2 associated with space heating (secondary)

(309) x

0

=

0 (374)

CO2 associated with water from immersion heater or instantaneous heater

(312) x

0.22

=

0 (375)

Total CO2 associated with space and water heating

(373) + (374) + (375) =

1125.66 (376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	=	25.17	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	170.54	(379)
Total CO2, kg/year	sum of (376)...(382) =			1321.37	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			17.63	(384)
El rating (section 14)				85.24	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: a1-2-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

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

2. Ventilation rate:

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

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

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

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

DER WorkSheet: New dwelling design stage

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			6.44	$\frac{1}{1/(1.2) + 0.04}$	7.37		
Windows Type 2			2.76	$\frac{1}{1/(1.2) + 0.04}$	3.16		
Floor			53.81	0.11	5.9191		
Walls Type1	19.19	9.2	9.99	0.18	1.8		
Walls Type2	16.19	2.1	14.09	0.18	2.54		
Total area of elements, m²			89.19				
Party wall			35.3	0	0		

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

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

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

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 7.88 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 31.19 (37)

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

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

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

(39)m=	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5
Average = Sum(39) _{1...12} /12=												52.5 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98		
Average = Sum(40) _{1...12} /12=													0.98	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

1.8

(42)

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

if TFA ≤ 13.9, N = 1

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

77.01

(43)

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

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

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

(44)m=	84.71	81.63	78.55	75.47	72.39	69.31	69.31	72.39	75.47	78.55	81.63	84.71		
Total = Sum(44) _{1...12} =													924.09	(44)

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

(45)m=	125.62	109.87	113.37	98.84	94.84	81.84	75.84	87.02	88.06	102.63	112.03	121.66		
Total = Sum(45) _{1...12} =													1211.63	(45)

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

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

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

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

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

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

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

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

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

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

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

(62)m=

180.9	159.8	168.65	152.34	150.12	135.33	131.11	142.3	141.56	157.91	165.52	176.93

 (62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

180.9	159.8	168.65	152.34	150.12	135.33	131.11	142.3	141.56	157.91	165.52	176.93

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

1862.47

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

85.99	76.47	81.92	75.66	75.76	70.01	69.44	73.16	72.08	78.35	80.04	84.67

 (65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12

 (66)

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

(67)m=

14.14	12.56	10.22	7.73	5.78	4.88	5.27	6.85	9.2	11.68	13.63	14.54

 (67)

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

(68)m=

157.11	158.74	154.64	145.89	134.85	124.47	117.54	115.91	120.02	128.76	139.8	150.18

 (68)

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

(69)m=

32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

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

(71)m=

-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1

 (71)

Water heating gains (Table 5)

(72)m=

115.58	113.8	110.11	105.08	101.82	97.23	93.33	98.33	100.11	105.3	111.17	113.81

 (72)

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

(73)m=

336.87	335.14	324.99	308.74	292.49	276.62	266.18	271.13	279.36	295.79	314.65	328.56

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)							
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.44</td></tr></table>	6.44	x	<table><tr><td>19.64</td></tr></table>	19.64	x	<table><tr><td>0.5</td></tr></table>	0.5	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>35.06</td></tr></table> (76)	35.06
0.77																		
6.44																		
19.64																		
0.5																		
0.8																		
35.06																		
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.76</td></tr></table>	2.76	x	<table><tr><td>19.64</td></tr></table>	19.64	x	<table><tr><td>0.5</td></tr></table>	0.5	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>15.03</td></tr></table> (76)	15.03
0.77																		
2.76																		
19.64																		
0.5																		
0.8																		
15.03																		
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.44</td></tr></table>	6.44	x	<table><tr><td>38.42</td></tr></table>	38.42	x	<table><tr><td>0.5</td></tr></table>	0.5	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>68.59</td></tr></table> (76)	68.59
0.77																		
6.44																		
38.42																		
0.5																		
0.8																		
68.59																		
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.76</td></tr></table>	2.76	x	<table><tr><td>38.42</td></tr></table>	38.42	x	<table><tr><td>0.5</td></tr></table>	0.5	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>29.39</td></tr></table> (76)	29.39
0.77																		
2.76																		
38.42																		
0.5																		
0.8																		
29.39																		
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.44</td></tr></table>	6.44	x	<table><tr><td>63.27</td></tr></table>	63.27	x	<table><tr><td>0.5</td></tr></table>	0.5	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>112.95</td></tr></table> (76)	112.95
0.77																		
6.44																		
63.27																		
0.5																		
0.8																		
112.95																		

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East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	6.44	x	92.28	x	0.5	x	0.8	=	164.74	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	6.44	x	113.09	x	0.5	x	0.8	=	201.89	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	6.44	x	115.77	x	0.5	x	0.8	=	206.67	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	6.44	x	110.22	x	0.5	x	0.8	=	196.76	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	6.44	x	94.68	x	0.5	x	0.8	=	169.01	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	6.44	x	73.59	x	0.5	x	0.8	=	131.37	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	6.44	x	45.59	x	0.5	x	0.8	=	81.38	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	6.44	x	24.49	x	0.5	x	0.8	=	43.72	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	6.44	x	16.15	x	0.5	x	0.8	=	28.83	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

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

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

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

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.91	0.77	0.58	0.42	0.47	0.73	0.94	0.99	1	(86)

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

(87)m=	20.11	20.25	20.48	20.75	20.93	20.99	21	21	20.96	20.72	20.36	20.07	(87)

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

(88)m=	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	(88)

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

(89)m=	0.99	0.99	0.96	0.88	0.71	0.5	0.34	0.38	0.65	0.92	0.98	0.99	(89)

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

(90)m=	18.93	19.12	19.45	19.82	20.04	20.1	20.1	20.1	20.07	19.79	19.28	18.87	(90)

fLA = Living area ÷ (4) =

0.5 (91)

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

(92)m=	19.52	19.69	19.97	20.28	20.48	20.54	20.55	20.52	20.25	19.82	19.47	(92)

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

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(93)m=	19.52	19.69	19.97	20.28	20.48	20.54	20.55	20.55	20.52	20.25	19.82	19.47	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=	0.99	0.98	0.96	0.89	0.74	0.54	0.38	0.42	0.69	0.92	0.98	0.99	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	383.84	426.29	467.12	483.47	429.06	307.53	206.93	216.95	320.7	380.86	370.81	367.4	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	799.11	776.31	707	597.61	460.98	311.97	207.42	217.87	336.85	506.73	667.79	801.82	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	308.96	235.22	178.47	82.18	23.75	0	0	0	0	93.65	213.82	323.2	

Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$ 1459.26 (98)

Space heating requirement in $kWh/m^2/year$

27.12 (99)

9b. Energy requirements – Community heating scheme

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

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

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

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
1459.26

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 1532.22 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

1862.47

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 1955.59 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 34.88 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

34.82 (330a)

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

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 810.07 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 18.1 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 828.17 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		828.17 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 18.07 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 129.62 (379)
Total CO2, kg/year	sum of (376)...(382) =		975.87 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		18.14 (384)
EI rating (section 14)			86.77 (385)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: a1-2-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

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

2. Ventilation rate:

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

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

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

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

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

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

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

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

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

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

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 9.64 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 39.92 (37)

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

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

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

(39)m= 68.97 68.97 68.97 68.97 68.97 68.97 68.97 68.97 68.97 68.97 68.97 68.97

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94		
Average = Sum(40) _{1...12} /12=													0.94	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.32

(42)

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

if TFA ≤ 13.9, N = 1

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

89.41

(43)

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

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

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

(44)m=	98.35	94.77	91.2	87.62	84.05	80.47	80.47	84.05	87.62	91.2	94.77	98.35		
Total = Sum(44) _{1...12} =													1072.92	(44)

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

(45)m=	145.85	127.56	131.63	114.76	110.12	95.02	88.05	101.04	102.25	119.16	130.07	141.25		
Total = Sum(45) _{1...12} =													1406.77	(45)

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

(46)m=	21.88	19.13	19.75	17.21	16.52	14.25	13.21	15.16	15.34	17.87	19.51	21.19		(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

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

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

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

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

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

DER WorkSheet: New dwelling design stage

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

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

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

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

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

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

Output from water heater

(64)m=	201.13	177.49	186.91	168.25	165.39	148.52	143.33	156.32	155.74	174.44	183.57	196.53	
Output from water heater (annual) _{1...12}												2057.61	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

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

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

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

Metabolic gains (Table 5), Watts

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

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

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

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

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

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

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

Pumps and fans gains (Table 5a)

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

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

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

Water heating gains (Table 5)

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

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

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

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
East	0.9x	0.77	x	5.06	x	19.64	x	0.5	x	0.8	=	27.55	(76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	5.06	x	38.42	x	0.5	x	0.8	=	53.89	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	5.06	x	63.27	x	0.5	x	0.8	=	88.75	(76)

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

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

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

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

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

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	1	0.99	0.98	0.94	0.83	0.64	0.47	0.52	0.77	0.96	0.99	1

(86)

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

(87)m= 20.11 20.24 20.46 20.71 20.9 20.98 21 21 20.95 20.7 20.35 20.07 (87)

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

(88)m=	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	(88)

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

(89)m=	1	0.99	0.97	0.92	0.78	0.56	0.38	0.42	0.69	0.94	0.99	1	(89)

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

(90)m=	18.95	19.14	19.44	19.79	20.04	20.12	20.13	20.13	20.1	19.79	19.29	18.89	(90)

fLA = Living area ÷ (4) =	0.4	(91)

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

(92)m=	19.41	19.58	19.85	20.16	20.38	20.47	20.48	20.48	20.44	20.16	19.72	19.36	(92)

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

(93)m=	19.41	19.58	19.85	20.16	20.38	20.47	20.48	20.48	20.44	20.16	19.72	19.36	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.97	0.92	0.79	0.59	0.42	0.46	0.72	0.94	0.99	1	(94)

Useful gains, hmGm, W = (94)m x (84)m

(95)m=	481.98	539.65	585.38	601.2	542.2	395.95	266.59	279.63	412.08	483.97	467.57	459.73	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm, W = [(39)m x [(93)m – (96)m]

(97)m=	1042.17	1012.51	920.64	776.51	598.74	404.53	267.49	281.2	437.06	659.15	870.11	1045.62	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	416.78	317.76	249.44	126.22	42.07	0	0	0	0	130.33	289.82	435.9	(98)

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	2008.33	(98)

Space heating requirement in kWh/m²/year

27.38	(99)

9b. Energy requirements – Community heating scheme

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

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)

Fraction of space heat from community system 1 – (301) =

1	(302)

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

Fraction of heat from Community boilers

1	(303a)

Fraction of total space heat from Community boilers

(302) x (303a) =	1	(304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)

Distribution loss factor (Table 12c) for community heating system

1.05	(306)

Space heating

Annual space heating requirement

kWh/year

2008.33	(307a)

Space heat from Community boilers

(98) x (304a) x (305) x (306) =	2108.74	(307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0	(308)

DER WorkSheet: New dwelling design stage

Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)
Water heating			
Annual water heating requirement		2057.61	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	2160.49	(310a)
Electricity used for heat distribution	$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$	42.69	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.46	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	47.46	(331)
Energy for lighting (calculated in Appendix L)		334.76	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		
			93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 991.56 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 22.16 (372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$		= 1013.72 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1013.72 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 24.63 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 173.74 (379)
Total CO2, kg/year	sum of (376) ... (382) =		1212.1 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		16.52 (384)
EI rating (section 14)			86.28 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: a1-2-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

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

2. Ventilation rate:

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

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

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

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

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

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

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

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

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 11.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 50.47 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

79.15	79.15	79.15	79.15	79.15	79.15	79.15	79.15	79.15	79.15	79.15	79.15

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

79.15

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09

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

1.09

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.3

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

88.91

(43)

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

Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

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

97.8	94.24	90.68	87.13	83.57	80.02	80.02	83.57	87.13	90.68	94.24	97.8

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

1066.87

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

145.03	126.84	130.89	114.11	109.5	94.49	87.56	100.47	101.67	118.49	129.34	140.45

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

1398.84

(45)

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

(46)m=

21.75	19.03	19.63	17.12	16.42	14.17	13.13	15.07	15.25	17.77	19.4	21.07

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

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

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

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

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

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(56)

DER WorkSheet: New dwelling design stage

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

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

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

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

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

 (59)

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

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

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

(62)m=

200.31	176.77	186.17	167.61	164.77	147.98	142.83	155.75	155.16	173.76	182.83	195.73

 (62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

200.31	176.77	186.17	167.61	164.77	147.98	142.83	155.75	155.16	173.76	182.83	195.73

Output from water heater (annual) ^{1...12}	2049.68

 (64)

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

(65)m=

92.44	82.12	87.74	80.74	80.63	74.21	73.33	77.63	76.6	83.62	85.8	90.92

 (65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17

 (66)

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

(67)m=

18.09	16.06	13.06	9.89	7.39	6.24	6.74	8.77	11.77	14.94	17.44	18.59

 (67)

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

(68)m=

202.88	204.98	199.68	188.38	174.13	160.73	151.78	149.67	154.98	166.27	180.53	193.93

 (68)

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

(69)m=

34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

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

(71)m=

-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14

 (71)

Water heating gains (Table 5)

(72)m=

124.25	122.2	117.93	112.14	108.37	103.07	98.57	104.34	106.39	112.39	119.17	122.21

 (72)

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

(73)m=

402.77	400.8	388.23	367.96	347.44	327.59	314.64	320.33	330.68	351.15	374.68	392.27

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	5.98	x	46.75	x	0.5	x	0.8	=	77.5	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	5.98	x	76.57	x	0.5	x	0.8	=	126.92	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	5.98	x	97.53	x	0.5	x	0.8	=	161.68	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	5.98	x	110.23	x	0.5	x	0.8	=	182.73	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	5.98	x	114.87	x	0.5	x	0.8	=	190.42	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	5.98	x	110.55	x	0.5	x	0.8	=	183.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	5.98	x	108.01	x	0.5	x	0.8	=	179.05	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	5.98	x	104.89	x	0.5	x	0.8	=	173.88	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	5.98	x	101.89	x	0.5	x	0.8	=	168.89	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	5.98	x	82.59	x	0.5	x	0.8	=	136.9	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	5.98	x	55.42	x	0.5	x	0.8	=	91.86	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	5.98	x	40.4	x	0.5	x	0.8	=	66.97	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	153.34	263.89	365.39	455.34	509.03	504.02	486.55	447.29	396.98	293.09	184.22	130.83	(83)

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

(84)m=	556.11	664.69	753.62	823.3	856.48	831.61	801.19	767.62	727.66	644.25	558.91	523.1	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.77	0.59	0.43	0.47	0.7	0.92	0.99	1	(86)

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

(87)m=	19.99	20.19	20.44	20.71	20.9	20.98	21	20.99	20.95	20.7	20.28	19.94	(87)

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

(88)m=	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	(88)

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

(89)m=	0.99	0.98	0.95	0.87	0.71	0.51	0.34	0.37	0.62	0.89	0.98	0.99	(89)

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

(90)m=	18.68	18.96	19.32	19.69	19.92	19.99	20.01	20	19.97	19.68	19.1	18.6	(90)

fLA = Living area ÷ (4) =

0.4 (91)

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

(92)m=	19.2	19.45	19.77	20.1	20.31	20.39	20.4	20.4	20.36	20.09	19.57	19.14	(92)

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

DER WorkSheet: New dwelling design stage

(93)m=	19.2	19.45	19.77	20.1	20.31	20.39	20.4	20.4	20.36	20.09	19.57	19.14	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=	0.99	0.98	0.94	0.87	0.73	0.54	0.37	0.41	0.65	0.9	0.98	0.99	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	550.32	648.35	710.79	715.35	626.03	448.83	299.8	314.84	472.5	577.62	546.2	519	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	1179.62	1151.67	1050.41	886.21	681.39	458.13	300.91	316.65	495.82	751.09	987	1182.28	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	468.2	338.23	252.67	123.02	41.19	0	0	0	0	129.06	317.37	493.48	

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 2163.22 (98)

Space heating requirement in $kWh/m^2/year$

29.87 (99)

9b. Energy requirements – Community heating scheme

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

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

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

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2163.22

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 2271.38 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2049.68

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2152.16 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 44.24 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

46.86 (330a)

DER WorkSheet: New dwelling design stage

warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	46.86	(331)
Energy for lighting (calculated in Appendix L)		319.42	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1027.4 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 22.96 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1050.36 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1050.36 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 24.32 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 165.78 (379)
Total CO2, kg/year	sum of (376)...(382) =		1240.46 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		17.13 (384)
EI rating (section 14)			85.84 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: a1-2-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	120.39 (1a) x	2.4 (2a) =	288.94 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	120.39 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	288.94 (5)

2. Ventilation rate:

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

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

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

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

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

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

DER WorkSheet: New dwelling design stage

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		(26)
Windows Type 1			3.68	$\times 1/[1/(1.2) + 0.04]$	4.21		(27)
Windows Type 2			5.06	$\times 1/[1/(1.2) + 0.04]$	5.79		(27)
Windows Type 3			3.22	$\times 1/[1/(1.2) + 0.04]$	3.69		(27)
Windows Type 4			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 5			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Floor			120.39	0.11	13.2429		(28)
Walls Type1	32.79	17.48	15.31	0.18	2.76		(29)
Walls Type2	25.04	2.1	22.94	0.18	4.13		(29)
Total area of elements, m²			178.22				(31)
Party wall			61.8	0	0		(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 42.66 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 10.91 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 53.58 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

101.25	101.25	101.25	101.25	101.25	101.25	101.25	101.25	101.25	101.25	101.25	101.25

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

101.25

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84

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

0.84

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.86

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

102.24

(43)

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

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

Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

112.46	108.37	104.28	100.19	96.1	92.02	92.02	96.1	100.19	104.28	108.37	112.46

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

1226.87

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

166.78	145.87	150.52	131.23	125.92	108.66	100.69	115.54	116.92	136.26	148.74	161.52

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

1608.62

(45)

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

(46)m=

25.02	21.88	22.58	19.68	18.89	16.3	15.1	17.33	17.54	20.44	22.31	24.23

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

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

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

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

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

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(56)

DER WorkSheet: New dwelling design stage

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

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

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

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

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

 (59)

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

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

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

(62)m=

222.06	195.79	205.8	184.72	181.19	162.15	155.96	170.82	170.41	191.53	202.23	216.79

 (62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

222.06	195.79	205.8	184.72	181.19	162.15	155.96	170.82	170.41	191.53	202.23	216.79

Output from water heater (annual) ^{1...12}	2259.46

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

99.68	88.44	94.27	86.43	86.09	78.92	77.7	82.64	81.67	89.53	92.25	97.93

 (65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24

 (66)

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

(67)m=

26.39	23.44	19.06	14.43	10.79	9.11	9.84	12.79	17.17	21.8	25.44	27.12

 (67)

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

(68)m=

285.72	288.68	281.21	265.31	245.23	226.36	213.75	210.79	218.26	234.16	254.24	273.11

 (68)

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

(69)m=

37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

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

(71)m=

-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59

 (71)

Water heating gains (Table 5)

(72)m=

133.97	131.61	126.71	120.04	115.71	109.62	104.43	111.07	113.43	120.33	128.12	131.62

 (72)

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

(73)m=

512.05	509.71	492.95	465.75	437.7	411.05	394	400.62	414.83	442.27	473.78	497.83

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	3.68	x	10.63	x	0.5	x	0.8	=	10.85	(74)
North	0.9x	0.77	x	5.06	x	10.63	x	0.5	x	0.8	=	14.91	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	3.68	x	20.32	x	0.5	x	0.8	=	20.73	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.5	x	0.8	=	28.5	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	3.68	x	34.53	x	0.5	x	0.8	=	35.22	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.5	x	0.8	=	48.43	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	3.68	x	55.46	x	0.5	x	0.8	=	56.58	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.5	x	0.8	=	77.8	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	3.68	x	74.72	x	0.5	x	0.8	=	76.22	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.5	x	0.8	=	104.8	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	3.68	x	79.99	x	0.5	x	0.8	=	81.59	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.5	x	0.8	=	112.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	3.68	x	74.68	x	0.5	x	0.8	=	76.18	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.5	x	0.8	=	104.74	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	3.68	x	59.25	x	0.5	x	0.8	=	60.44	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.5	x	0.8	=	83.1	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	3.68	x	41.52	x	0.5	x	0.8	=	42.35	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.5	x	0.8	=	58.23	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	3.68	x	24.19	x	0.5	x	0.8	=	24.68	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.5	x	0.8	=	33.93	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	3.68	x	13.12	x	0.5	x	0.8	=	13.38	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	5.06	x	13.12	x	0.5	x	0.8	=	18.4	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	3.68	x	8.86	x	0.5	x	0.8	=	9.04	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.5	x	0.8	=	12.43	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
South	0.9x	0.77	x	3.22	x	46.75	x	0.5	x	0.8	=	41.73	(78)
South	0.9x	0.77	x	3.22	x	76.57	x	0.5	x	0.8	=	68.34	(78)
South	0.9x	0.77	x	3.22	x	97.53	x	0.5	x	0.8	=	87.06	(78)
South	0.9x	0.77	x	3.22	x	110.23	x	0.5	x	0.8	=	98.39	(78)
South	0.9x	0.77	x	3.22	x	114.87	x	0.5	x	0.8	=	102.53	(78)
South	0.9x	0.77	x	3.22	x	110.55	x	0.5	x	0.8	=	98.67	(78)
South	0.9x	0.77	x	3.22	x	108.01	x	0.5	x	0.8	=	96.41	(78)
South	0.9x	0.77	x	3.22	x	104.89	x	0.5	x	0.8	=	93.63	(78)
South	0.9x	0.77	x	3.22	x	101.89	x	0.5	x	0.8	=	90.94	(78)
South	0.9x	0.77	x	3.22	x	82.59	x	0.5	x	0.8	=	73.71	(78)
South	0.9x	0.77	x	3.22	x	55.42	x	0.5	x	0.8	=	49.46	(78)
South	0.9x	0.77	x	3.22	x	40.4	x	0.5	x	0.8	=	36.06	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	83.76	148.67	223.55	317.64	397.87	414.85	391.6	327.82	255.05	169.33	101.32	71.1	(83)

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

(84)m=	595.82	658.38	716.5	783.39	835.57	825.9	785.6	728.44	669.88	611.6	575.1	568.93	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.98	0.91	0.74	0.56	0.63	0.88	0.99	1	1	(86)

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

(87)m=	20.09	20.2	20.38	20.62	20.85	20.97	21	20.99	20.91	20.63	20.31	20.06	(87)

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

(88)m=	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	(88)

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

(89)m=	1	1	0.99	0.97	0.88	0.67	0.46	0.53	0.83	0.98	1	1	(89)

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

(90)m=	18.99	19.14	19.4	19.75	20.06	20.2	20.22	20.21	20.14	19.77	19.3	18.94	(90)

fLA = Living area ÷ (4) = 0.3 (91)

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

(92)m=	19.32	19.45	19.69	20.01	20.3	20.43	20.45	20.37	20.02	19.61	19.28	(92)

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

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(93)m=	19.32	19.45	19.69	20.01	20.3	20.43	20.45	20.45	20.37	20.02	19.61	19.28	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=	1	1	0.99	0.97	0.88	0.69	0.49	0.56	0.84	0.98	1	1	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	595	656.44	710.67	759.22	738.61	569.69	387.77	405.53	564.42	598.99	573.24	568.35	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	1520.75	1473.58	1335.66	1125.21	870.81	590.29	389.84	409.84	635.13	954.26	1266.3	1526.79	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	688.76	549.12	464.99	263.52	98.36	0	0	0	0	264.32	499	713.08	(98)

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 3541.14 (98)

Space heating requirement in $kWh/m^2/year$

(99)	29.41

9b. Energy requirements – Community heating scheme

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

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

(301)	0

Fraction of space heat from community system 1 – (301) =

(302)	1

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

Fraction of heat from Community boilers

(303a)	1

Fraction of total space heat from Community boilers

(302) x (303a) =

(304a)	1

Factor for control and charging method (Table 4c(3)) for community heating system

(305)	1

Distribution loss factor (Table 12c) for community heating system

(306)	1.05

Space heating

Annual space heating requirement

kWh/year	3541.14

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

(307a)	3718.2

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

(308)	0

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

(309)	0

Water heating

Annual water heating requirement

	2259.46

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

(310a)	2372.43

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$

(313)	60.91

Cooling System Energy Efficiency Ratio

(314)	0

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

(315)	0

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

(330a)	77.9

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	77.9	(331)
Energy for lighting (calculated in Appendix L)		466.03	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1414.6 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 31.61 (372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$		= 1446.21 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1446.21 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 40.43 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 241.87 (379)
Total CO2, kg/year	sum of (376) ... (382) =		1728.51 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		14.36 (384)
EI rating (section 14)			86 (385)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: a1-3-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

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

2. Ventilation rate:

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

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

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

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

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

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			5.98	$\times 1/[1/(1.2) + 0.04]$	6.85		
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 3			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 4			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Walls Type1	41.4	14.26	27.14	0.18	4.89		
Walls Type2	10.58	2.1	8.48	0.18	1.53		
Total area of elements, m²			51.98				
Party wall			38.59	0	0		

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 25.26 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 6.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 31.91 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68

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

(39)m= 61.58 61.58 61.58 61.58 61.58 61.58 61.58 61.58 61.58 61.58 61.58 61.58 (39)

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Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82		
Average = Sum(40) _{1...12} /12=													0.82	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.36

(42)

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

if TFA ≤ 13.9, N = 1

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

90.25

(43)

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

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

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

(44)m=	99.27	95.66	92.05	88.44	84.83	81.22	81.22	84.83	88.44	92.05	95.66	99.27		
Total = Sum(44) _{1...12} =													1082.96	(44)

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

(45)m=	147.22	128.76	132.87	115.83	111.15	95.91	88.88	101.99	103.2	120.27	131.29	142.57		
Total = Sum(45) _{1...12} =													1419.93	(45)

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

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

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

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

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

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

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

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

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

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

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

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

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

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

Output from water heater

(64)m=	202.49	178.68	188.14	169.33	166.42	149.4	144.15	157.26	156.7	175.55	184.78	197.85	
Output from water heater (annual) _{1...12}												2070.77	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

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

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

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

Metabolic gains (Table 5), Watts

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

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

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

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

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

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

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

Pumps and fans gains (Table 5a)

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

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

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

Water heating gains (Table 5)

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

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

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

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.98	x	10.63	x	0.5	x	0.8	=	17.63	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	5.98	x	20.32	x	0.5	x	0.8	=	33.69	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)

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North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.98	x	34.53	x	0.5	x	0.8	=	57.24	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.98	x	55.46	x	0.5	x	0.8	=	91.94	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.98	x	74.72	x	0.5	x	0.8	=	123.85	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.98	x	79.99	x	0.5	x	0.8	=	132.59	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.98	x	74.68	x	0.5	x	0.8	=	123.79	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.98	x	59.25	x	0.5	x	0.8	=	98.21	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.98	x	41.52	x	0.5	x	0.8	=	68.82	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.98	x	24.19	x	0.5	x	0.8	=	40.1	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.98	x	13.12	x	0.5	x	0.8	=	21.74	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.98	x	8.86	x	0.5	x	0.8	=	14.69	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

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

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

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

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.78	0.58	0.42	0.48	0.76	0.96	0.99	1	(86)

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

(87)m=	20.24	20.35	20.54	20.78	20.95	20.99	21	21	20.97	20.75	20.45	20.21	(87)

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

(88)m=	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	(88)

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

(89)m=	1	0.99	0.98	0.91	0.74	0.51	0.35	0.4	0.69	0.95	0.99	1	(89)

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

(90)m=	19.21	19.37	19.64	19.98	20.19	20.23	20.23	20.23	20.21	19.94	19.51	19.16	(90)

fLA = Living area ÷ (4) =

0.4	(91)

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

(92)m=	19.62	19.76	20	20.3	20.49	20.54	20.54	20.54	20.51	20.27	19.89	19.58	(92)

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

(93)m=	19.62	19.76	20	20.3	20.49	20.54	20.54	20.54	20.51	20.27	19.89	19.58	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.92	0.75	0.54	0.38	0.43	0.72	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	457.69	498.63	541.23	569.68	511.6	362.71	242.42	254.37	378.28	445.2	438.23	439.16	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	943.69	914.97	831.36	702.13	541.3	365.55	242.65	254.94	394.89	595.28	787.36	947.25	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	361.58	279.78	215.85	95.36	22.1	0	0	0	0	111.66	251.37	378.02	(98)

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

1715.73	(98)

Space heating requirement in kWh/m²/year

22.89	(99)

9b. Energy requirements – Community heating scheme

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

DER WorkSheet: New dwelling design stage

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)
<i>The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.</i>			
Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		kWh/year	
Annual space heating requirement		1715.73	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1801.52	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2070.77	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2174.31	(310a)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	39.76	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		48.49	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	48.49	(331)
Energy for lighting (calculated in Appendix L)		328.59	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	= 923.42 (367)
Electrical energy for heat distribution	[(313) x	0.52	= 20.63 (372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)		= 944.05 (373)
CO2 associated with space heating (secondary)	(309) x	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	= 0 (375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		944.05 (376)
CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	= 25.17 (378)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for lighting	(332))) x	0.52	=	170.54	(379)
Total CO2, kg/year	sum of (376)...(382) =			1139.76	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.21	(384)
El rating (section 14)				87.27	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: a1-3-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

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

2. Ventilation rate:

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

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

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

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

DER WorkSheet: New dwelling design stage

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			6.44	$\times 1/[1/(1.2) + 0.04]$	7.37		
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Walls Type1	19.19	9.2	9.99	0.18	1.8		
Walls Type2	16.19	2.1	14.09	0.18	2.54		
Total area of elements, m²			35.38				
Party wall			35.3	0	0		

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 17.39 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 4.52 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.91 (37)

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

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

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

(39)m=	43.22	43.22	43.22	43.22	43.22	43.22	43.22	43.22	43.22	43.22	43.22	43.22
Average = Sum(39) _{1...12} /12=												43.22 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8		
Average = Sum(40) _{1...12} /12=													0.8	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

1.8

(42)

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

if TFA ≤ 13.9, N = 1

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

77.01

(43)

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

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

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

(44)m=	84.71	81.63	78.55	75.47	72.39	69.31	69.31	72.39	75.47	78.55	81.63	84.71		
Total = Sum(44) _{1...12} =													924.09	(44)

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

(45)m=	125.62	109.87	113.37	98.84	94.84	81.84	75.84	87.02	88.06	102.63	112.03	121.66		
Total = Sum(45) _{1...12} =													1211.63	(45)

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

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

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

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

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

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

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

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

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

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

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

(62)m=

180.9	159.8	168.65	152.34	150.12	135.33	131.11	142.3	141.56	157.91	165.52	176.93

 (62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

180.9	159.8	168.65	152.34	150.12	135.33	131.11	142.3	141.56	157.91	165.52	176.93

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

1862.47

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

85.99	76.47	81.92	75.66	75.76	70.01	69.44	73.16	72.08	78.35	80.04	84.67

 (65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12	90.12

 (66)

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

(67)m=

14.14	12.56	10.22	7.73	5.78	4.88	5.27	6.85	9.2	11.68	13.63	14.54

 (67)

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

(68)m=

157.11	158.74	154.64	145.89	134.85	124.47	117.54	115.91	120.02	128.76	139.8	150.18

 (68)

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

(69)m=

32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01	32.01

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

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

(71)m=

-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1	-72.1

 (71)

Water heating gains (Table 5)

(72)m=

115.58	113.8	110.11	105.08	101.82	97.23	93.33	98.33	100.11	105.3	111.17	113.81

 (72)

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

(73)m=

336.87	335.14	324.99	308.74	292.49	276.62	266.18	271.13	279.36	295.79	314.65	328.56

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	6.44	x	19.64	x	0.5	x	0.8	=	35.06 (76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (76)
East	0.9x	0.77	x	6.44	x	38.42	x	0.5	x	0.8	=	68.59 (76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39 (76)
East	0.9x	0.77	x	6.44	x	63.27	x	0.5	x	0.8	=	112.95 (76)

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East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	6.44	x	92.28	x	0.5	x	0.8	=	164.74	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	6.44	x	113.09	x	0.5	x	0.8	=	201.89	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	6.44	x	115.77	x	0.5	x	0.8	=	206.67	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	6.44	x	110.22	x	0.5	x	0.8	=	196.76	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	6.44	x	94.68	x	0.5	x	0.8	=	169.01	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	6.44	x	73.59	x	0.5	x	0.8	=	131.37	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	6.44	x	45.59	x	0.5	x	0.8	=	81.38	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	6.44	x	24.49	x	0.5	x	0.8	=	43.72	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	6.44	x	16.15	x	0.5	x	0.8	=	28.83	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

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

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

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

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.85	0.67	0.48	0.35	0.39	0.63	0.91	0.98	0.99	(86)

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

(87)m=	20.37	20.5	20.7	20.89	20.98	21	21	21	20.99	20.86	20.57	20.33	(87)

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

(88)m=	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	(88)

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

(89)m=	0.99	0.98	0.94	0.82	0.62	0.43	0.29	0.32	0.56	0.88	0.98	0.99	(89)

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

(90)m=	19.42	19.6	19.88	20.13	20.23	20.25	20.25	20.25	20.24	20.1	19.71	19.36	(90)

fLA = Living area ÷ (4) =

0.5

(91)

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

(92)m=	19.89	20.05	20.29	20.51	20.61	20.62	20.63	20.63	20.62	20.48	20.14	19.85	(92)

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

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(93)m=	19.89	20.05	20.29	20.51	20.61	20.62	20.63	20.63	20.62	20.48	20.14	19.85	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=	0.99	0.98	0.94	0.83	0.65	0.45	0.32	0.36	0.6	0.89	0.98	0.99	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	383.04	423.78	457.82	453.44	376.55	259.64	173.91	182.49	277.92	365.12	368.48	366.9	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	673.93	654.67	595.84	501.83	384.91	260.33	173.96	182.6	281.65	426.91	563.52	676.2	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	216.42	155.16	102.68	34.84	6.23	0	0	0	0	45.97	140.43	230.12	

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 931.85 (98)

Space heating requirement in $kWh/m^2/year$

17.32 (99)

9b. Energy requirements – Community heating scheme

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

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

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

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

931.85

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

978.44 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

1862.47

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

1955.59 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$

29.34 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

34.82 (330a)

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

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 681.45 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 15.23 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 696.68 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		696.68 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 18.07 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 129.62 (379)
Total CO2, kg/year	sum of (376)...(382) =		844.37 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		15.69 (384)
EI rating (section 14)			88.55 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: a1-3-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

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

2. Ventilation rate:

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

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

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

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	0 [(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0 0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	0 (8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

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

Number of sides sheltered	2 (19)

Shelter factor	0.85 (20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	0.17 (21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			5.06	$\times 1/[1/(1.2) + 0.04]$	5.79		
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 3			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Walls Type1	41.75	10.58	31.17	0.18	5.61		
Walls Type2	13.03	2.1	10.93	0.18	1.97		
Total area of elements, m²			54.78				
Party wall			28.73	0	0		

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 22.21 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 6.03 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 28.24 (37)

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

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

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

(39)m=	57.29	57.29	57.29	57.29	57.29	57.29	57.29	57.29	57.29	57.29	57.29	57.29
Average = Sum(39) _{1...12} /12=												57.29 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78		
Average = Sum(40) _{1...12} /12=													0.78	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.32

(42)

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

if TFA ≤ 13.9, N = 1

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

89.41

(43)

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

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

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

(44)m=	98.35	94.77	91.2	87.62	84.05	80.47	80.47	84.05	87.62	91.2	94.77	98.35		
Total = Sum(44) _{1...12} =													1072.92	(44)

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

(45)m=	145.85	127.56	131.63	114.76	110.12	95.02	88.05	101.04	102.25	119.16	130.07	141.25		
Total = Sum(45) _{1...12} =													1406.77	(45)

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

(46)m=	21.88	19.13	19.75	17.21	16.52	14.25	13.21	15.16	15.34	17.87	19.51	21.19		(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

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

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

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

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

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

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

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

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

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

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

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

Output from water heater

(64)m=	201.13	177.49	186.91	168.25	165.39	148.52	143.33	156.32	155.74	174.44	183.57	196.53	
Output from water heater (annual) _{1...12}												2057.61	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

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

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

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

Metabolic gains (Table 5), Watts

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

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

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

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

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

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

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

Pumps and fans gains (Table 5a)

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

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

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

Water heating gains (Table 5)

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

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

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

6. Solar gains:

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

Orientation:	Access Factor Table 6d			Area m ²	Flux Table 6a			g_ Table 6b			FF Table 6c			Gains (W)	
East	0.9x	0.77	x	5.06	x	19.64	x	0.5	x	0.8	=	27.55	(76)		
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)		
East	0.9x	0.77	x	5.06	x	38.42	x	0.5	x	0.8	=	53.89	(76)		
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)		
East	0.9x	0.77	x	5.06	x	63.27	x	0.5	x	0.8	=	88.75	(76)		

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

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

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

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

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

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	1	0.99	0.97	0.9	0.74	0.55	0.39	0.43	0.67	0.93	0.99	1

(86)

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

(87)m= 20.35 20.48 20.66 20.86 20.97 21 21 21 20.99 20.84 20.55 20.31 (87)

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

(88)m=	20.27	20.27	20.27	20.27	20.27	20.27	20.27	20.27	20.27	20.27	20.27	20.27	(88)

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

(89)m=	0.99	0.99	0.96	0.87	0.7	0.49	0.33	0.36	0.61	0.9	0.98	1	(89)

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

(90)m=	19.4	19.58	19.85	20.11	20.24	20.27	20.27	20.27	20.26	20.09	19.69	19.34	(90)

fLA = Living area ÷ (4) =	0.4	(91)

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

(92)m=	19.78	19.94	20.17	20.41	20.53	20.56	20.56	20.56	20.55	20.39	20.03	19.73	(92)

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

(93)m=	19.78	19.94	20.17	20.41	20.53	20.56	20.56	20.56	20.55	20.39	20.03	19.73	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.88	0.71	0.51	0.36	0.39	0.64	0.91	0.98	0.99	(94)

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	481.4	537.5	577.34	574.38	487.85	339.76	226.85	238.19	362.93	468.25	465.62	459.4	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm, W = [(39)m × ((93)m – (96)m)]

(97)m=	886.82	861.62	783.29	659.24	505.89	341.39	226.97	238.41	369.54	560.95	741	889.74	(97)

Space heating requirement for each month, kWh/month = 0.024 × [(97)m – (95)m] × (41)m

(98)m=	301.63	217.81	153.22	61.1	13.42	0	0	0	0	68.97	198.27	320.17	(98)

Total per year (kWh/year) = Sum(98)1...5,9...12 =	1334.6	(98)

Space heating requirement in kWh/m²/year

18.19	(99)

9b. Energy requirements – Community heating scheme

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

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)

Fraction of space heat from community system 1 – (301) =

1	(302)

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

Fraction of heat from Community boilers

1	(303a)

Fraction of total space heat from Community boilers

(302) × (303a) =

1	(304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)

Distribution loss factor (Table 12c) for community heating system

1.05	(306)

Space heating

Annual space heating requirement

kWh/year

1334.6	(307a)

Space heat from Community boilers

(98) × (304a) × (305) × (306) =

1401.33	(307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0	(308)

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Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)
Water heating			
Annual water heating requirement		2057.61	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	2160.49	(310a)
Electricity used for heat distribution	$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$	35.62	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.46	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	47.46	(331)
Energy for lighting (calculated in Appendix L)		334.76	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		
			93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 827.26 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 18.49 (372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$		= 845.75 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		845.75 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 24.63 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 173.74 (379)
Total CO2, kg/year	sum of (376) ... (382) =		1044.12 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		14.23 (384)
EI rating (section 14)			88.18 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: a1-3-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

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

2. Ventilation rate:

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

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

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

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			5.98	$\times 1/[1/(1.2) + 0.04]$	6.85		
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 3			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 4			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		
Windows Type 5			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Walls Type1	46.63	16.1	30.53	0.18	5.5		
Walls Type2	26.01	2.1	23.91	0.18	4.3		
Total area of elements, m²			72.64				
Party wall			20.62	0	0		

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 30.75 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 8.03 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.78 (37)

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

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

DER WorkSheet: New dwelling design stage

(38)m=

28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68	28.68

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

67.46	67.46	67.46	67.46	67.46	67.46	67.46	67.46	67.46	67.46	67.46	67.46

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

67.46 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93

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

0.93 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

if TFA ≤ 13.9, N = 1

2.3 (42)

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

88.91 (43)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
97.8	94.24	90.68	87.13	83.57	80.02	80.02	83.57	87.13	90.68	94.24	97.8

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

97.8	94.24	90.68	87.13	83.57	80.02	80.02	83.57	87.13	90.68	94.24	97.8

Total = Sum(44)_{1...12} = 1066.87 (44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)
(45)m=

145.03	126.84	130.89	114.11	109.5	94.49	87.56	100.47	101.67	118.49	129.34	140.45

Total = Sum(45)_{1...12} = 1398.84 (45)

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

(46)m=

21.75	19.03	19.63	17.12	16.42	14.17	13.13	15.07	15.25	17.77	19.4	21.07

 (46)

Water storage loss:

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

0 (47)

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

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

Water storage loss:

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

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110 (50)

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

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

0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03 (52)

Temperature factor from Table 2b

0.6 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03 (54)

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

1.03 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

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

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

(59)

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

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

(61)

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

(62)m=	200.31	176.77	186.17	167.61	164.77	147.98	142.83	155.75	155.16	173.76	182.83	195.73

(62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

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

(63)

Output from water heater

(64)m=	200.31	176.77	186.17	167.61	164.77	147.98	142.83	155.75	155.16	173.76	182.83	195.73

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

2049.68

(64)

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

(65)m=	92.44	82.12	87.74	80.74	80.63	74.21	73.33	77.63	76.6	83.62	85.8	90.92

(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17	115.17

(66)

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

(67)m=	18.09	16.06	13.06	9.89	7.39	6.24	6.74	8.77	11.77	14.94	17.44	18.59

(67)

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

(68)m=	202.88	204.98	199.68	188.38	174.13	160.73	151.78	149.67	154.98	166.27	180.53	193.93

(68)

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

(69)m=	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52	34.52

(69)

Pumps and fans gains (Table 5a)

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

(70)

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

(71)m=	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14	-92.14

(71)

Water heating gains (Table 5)

(72)m=	124.25	122.2	117.93	112.14	108.37	103.07	98.57	104.34	106.39	112.39	119.17	122.21

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	402.77	400.8	388.23	367.96	347.44	327.59	314.64	320.33	330.68	351.15	374.68	392.27

(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
South	0.9x	0.77	x	5.98	x	46.75	x	0.5	x	0.8	=	77.5	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)

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South	0.9x	0.77	x	5.98	x	76.57	x	0.5	x	0.8	=	126.92	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	5.98	x	97.53	x	0.5	x	0.8	=	161.68	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	5.98	x	110.23	x	0.5	x	0.8	=	182.73	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	5.98	x	114.87	x	0.5	x	0.8	=	190.42	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	5.98	x	110.55	x	0.5	x	0.8	=	183.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	5.98	x	108.01	x	0.5	x	0.8	=	179.05	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	5.98	x	104.89	x	0.5	x	0.8	=	173.88	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	5.98	x	101.89	x	0.5	x	0.8	=	168.89	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	5.98	x	82.59	x	0.5	x	0.8	=	136.9	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	5.98	x	55.42	x	0.5	x	0.8	=	91.86	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	5.98	x	40.4	x	0.5	x	0.8	=	66.97	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)

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West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	153.34	263.89	365.39	455.34	509.03	504.02	486.55	447.29	396.98	293.09	184.22	130.83	(83)

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

(84)m=	556.11	664.69	753.62	823.3	856.48	831.61	801.19	767.62	727.66	644.25	558.91	523.1	(84)

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.85	0.7	0.51	0.37	0.4	0.62	0.89	0.98	0.99	(86)

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

(87)m=	20.22	20.41	20.64	20.85	20.96	20.99	21	21	20.98	20.83	20.47	20.17	(87)

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

(88)m=	20.14	20.14	20.14	20.14	20.14	20.14	20.14	20.14	20.14	20.14	20.14	20.14	(88)

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

(89)m=	0.99	0.97	0.93	0.82	0.64	0.45	0.3	0.33	0.55	0.86	0.97	0.99	(89)

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

(90)m=	19.12	19.39	19.7	19.97	20.11	20.14	20.14	20.14	20.13	19.96	19.48	19.04	(90)

fLA = Living area ÷ (4) =

0.4

(91)

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

(92)m=	19.56	19.8	20.08	20.32	20.45	20.48	20.48	20.48	20.47	20.31	19.88	19.49	(92)

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

(93)m=	19.56	19.8	20.08	20.32	20.45	20.48	20.48	20.48	20.47	20.31	19.88	19.49	(93)

8. Space heating requirement

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

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

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Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.93	0.83	0.66	0.47	0.33	0.36	0.58	0.86	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	549.54	644.47	697.52	680.63	568.65	394.16	261.79	275.1	422	556.22	543.35	518.59	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1029.37	1004.87	915.86	770.59	590.1	396.67	262.02	275.49	429.79	654.76	861.89	1031.68	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	356.99	242.19	162.44	64.77	15.96	0	0	0	0	73.31	229.35	381.74	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1526.75 (98)

Space heating requirement in kWh/m²/year

21.08 (99)

9b. Energy requirements – Community heating scheme

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

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

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

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
1526.75

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 1603.09 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2049.68

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2152.16 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] = 37.55 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

46.86 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) = 46.86 (331)

DER WorkSheet: New dwelling design stage

Energy for lighting (calculated in Appendix L)

319.42 (332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 872.19 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 19.49 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 891.68 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		891.68 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 24.32 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 165.78 (379)
Total CO2, kg/year	sum of (376)...(382) =		1081.78 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		14.94 (384)
EI rating (section 14)			87.65 (385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: a1-3-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	120.39 (1a) x	2.4 (2a) =	288.94 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	120.39 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	288.94 (5)

2. Ventilation rate:

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

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

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

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

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

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			5.06	$\times 1/[1/(1.2) + 0.04]$	5.79		
Windows Type 2			3.68	$\times 1/[1/(1.2) + 0.04]$	4.21		
Windows Type 3			3.22	$\times 1/[1/(1.2) + 0.04]$	3.69		
Windows Type 4			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 5			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Walls Type1	32.79	17.48	15.31	0.18	2.76		
Walls Type2	25.04	2.1	22.94	0.18	4.13		
Total area of elements, m²			57.83				
Party wall			61.8	0	0		

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 29.42 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 7.68 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.1 (37)

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

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

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(38)m=

47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

84.77	84.77	84.77	84.77	84.77	84.77	84.77	84.77	84.77	84.77	84.77	84.77

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

84.77

 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7

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

0.7

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

if TFA ≤ 13.9, N = 1

2.86

 (42)

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

102.24

 (43)

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

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

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

(44)m=

112.46	108.37	104.28	100.19	96.1	92.02	92.02	96.1	100.19	104.28	108.37	112.46

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

1226.87

 (44)

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

(45)m=

166.78	145.87	150.52	131.23	125.92	108.66	100.69	115.54	116.92	136.26	148.74	161.52

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

1608.62

 (45)

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

(46)m=

25.02	21.88	22.58	19.68	18.89	16.3	15.1	17.33	17.54	20.44	22.31	24.23

 (46)

Water storage loss:

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

0

 (47)

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

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

Water storage loss:

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

0

 (48)

Temperature factor from Table 2b

0

 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110

 (50)

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

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

0.02

 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

 (52)

Temperature factor from Table 2b

0.6

 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03

 (54)

Enter (50) or (54) in (55)

1.03

 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	222.06	195.79	205.8	184.72	181.19	162.15	155.96	170.82	170.41	191.53	202.23	216.79

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=	222.06	195.79	205.8	184.72	181.19	162.15	155.96	170.82	170.41	191.53	202.23	216.79

Output from water heater (annual)_{1...12}

2259.46

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	99.68	88.44	94.27	86.43	86.09	78.92	77.7	82.64	81.67	89.53	92.25	97.93

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	26.39	23.44	19.06	14.43	10.79	9.11	9.84	12.79	17.17	21.8	25.44	27.12

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	285.72	288.68	281.21	265.31	245.23	226.36	213.75	210.79	218.26	234.16	254.24	273.11

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32

(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59

(71)

Water heating gains (Table 5)

(72)m=	133.97	131.61	126.71	120.04	115.71	109.62	104.43	111.07	113.43	120.33	128.12	131.62

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	512.05	509.71	492.95	465.75	437.7	411.05	394	400.62	414.83	442.27	473.78	497.83

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.06	x	10.63	x	0.5	x	0.8	=	14.91 (74)
North	0.9x	0.77	x	3.68	x	10.63	x	0.5	x	0.8	=	10.85 (74)

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North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.5	x	0.8	=	28.5	(74)
North	0.9x	0.77	x	3.68	x	20.32	x	0.5	x	0.8	=	20.73	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.5	x	0.8	=	48.43	(74)
North	0.9x	0.77	x	3.68	x	34.53	x	0.5	x	0.8	=	35.22	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.5	x	0.8	=	77.8	(74)
North	0.9x	0.77	x	3.68	x	55.46	x	0.5	x	0.8	=	56.58	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.5	x	0.8	=	104.8	(74)
North	0.9x	0.77	x	3.68	x	74.72	x	0.5	x	0.8	=	76.22	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.5	x	0.8	=	112.19	(74)
North	0.9x	0.77	x	3.68	x	79.99	x	0.5	x	0.8	=	81.59	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.5	x	0.8	=	104.74	(74)
North	0.9x	0.77	x	3.68	x	74.68	x	0.5	x	0.8	=	76.18	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.5	x	0.8	=	83.1	(74)
North	0.9x	0.77	x	3.68	x	59.25	x	0.5	x	0.8	=	60.44	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.5	x	0.8	=	58.23	(74)
North	0.9x	0.77	x	3.68	x	41.52	x	0.5	x	0.8	=	42.35	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.5	x	0.8	=	33.93	(74)
North	0.9x	0.77	x	3.68	x	24.19	x	0.5	x	0.8	=	24.68	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.06	x	13.12	x	0.5	x	0.8	=	18.4	(74)
North	0.9x	0.77	x	3.68	x	13.12	x	0.5	x	0.8	=	13.38	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)

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North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.5	x	0.8	=	12.43	(74)
North	0.9x	0.77	x	3.68	x	8.86	x	0.5	x	0.8	=	9.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
South	0.9x	0.77	x	3.22	x	46.75	x	0.5	x	0.8	=	41.73	(78)
South	0.9x	0.77	x	3.22	x	76.57	x	0.5	x	0.8	=	68.34	(78)
South	0.9x	0.77	x	3.22	x	97.53	x	0.5	x	0.8	=	87.06	(78)
South	0.9x	0.77	x	3.22	x	110.23	x	0.5	x	0.8	=	98.39	(78)
South	0.9x	0.77	x	3.22	x	114.87	x	0.5	x	0.8	=	102.53	(78)
South	0.9x	0.77	x	3.22	x	110.55	x	0.5	x	0.8	=	98.67	(78)
South	0.9x	0.77	x	3.22	x	108.01	x	0.5	x	0.8	=	96.41	(78)
South	0.9x	0.77	x	3.22	x	104.89	x	0.5	x	0.8	=	93.63	(78)
South	0.9x	0.77	x	3.22	x	101.89	x	0.5	x	0.8	=	90.94	(78)
South	0.9x	0.77	x	3.22	x	82.59	x	0.5	x	0.8	=	73.71	(78)
South	0.9x	0.77	x	3.22	x	55.42	x	0.5	x	0.8	=	49.46	(78)
South	0.9x	0.77	x	3.22	x	40.4	x	0.5	x	0.8	=	36.06	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	83.76	148.67	223.55	317.64	397.87	414.85	391.6	327.82	255.05	169.33	101.32	71.1	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	595.82	658.38	716.5	783.39	835.57	825.9	785.6	728.44	669.88	611.6	575.1	568.93	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.86	0.65	0.47	0.53	0.82	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.3	20.4	20.56	20.77	20.94	20.99	21	21	20.97	20.76	20.49	20.27	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.34	20.34	20.34	20.34	20.34	20.34	20.34	20.34	20.34	20.34	20.34	20.34	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.95	0.82	0.58	0.4	0.46	0.76	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.39	19.53	19.76	20.06	20.28	20.33	20.34	20.34	20.31	20.05	19.65	19.34	(90)

fLA = Living area ÷ (4) =

0.3

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.66	19.79	20	20.27	20.47	20.53	20.54	20.54	20.51	20.26	19.9	19.62	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.66	19.79	20	20.27	20.47	20.53	20.54	20.54	20.51	20.26	19.9	19.62	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.95	0.83	0.6	0.42	0.48	0.77	0.97	1	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	594.95	656.09	708.65	746.75	690.21	498.11	333.34	349.83	518.02	593.14	572.89	568.34	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1302.22	1262.07	1144.48	964.22	743.83	502.76	333.63	350.54	543.17	819.1	1085.43	1307.34	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	526.21	407.22	324.26	156.58	39.89	0	0	0	0	168.11	369.03	549.82	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2541.12 (98)

Space heating requirement in kWh/m²/year

21.11 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2541.12

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 2668.18 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2259.46

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2372.43 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] = 50.41 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

77.9 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) = 77.9 (331)

DER WorkSheet: New dwelling design stage

Energy for lighting (calculated in Appendix L)

466.03

(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1170.72 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 26.16 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1196.88 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1196.88 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 40.43 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 241.87 (379)
Total CO2, kg/year	sum of (376)...(382) =		1479.18 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		12.29 (384)
EI rating (section 14)			88.02 (385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: a1-4-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	120.39 (1a)	2.4 (2a)	288.94 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	120.39 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	288.94 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.2	= 2.52		(26)
Windows Type 1			3.68	x 1/[1/(1.2)+0.04]	= 4.21		(27)
Windows Type 2			5.06	x 1/[1/(1.2)+0.04]	= 5.79		(27)
Windows Type 3			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 4			3.22	x 1/[1/(1.2)+0.04]	= 3.69		(27)
Windows Type 5			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Walls Type1	32.79	17.48	15.31	x 0.18	= 2.76		(29)
Walls Type2	25.04	2.1	22.94	x 0.18	= 4.13		(29)
Roof	34.94	0	34.94	x 0.11	= 3.84		(30)
Total area of elements, m²			92.77				(31)
Party wall			61.8	x 0	= 0		(32)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 33.26 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.44 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 44.71 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	47.67	(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	92.38	92.38	92.38	92.38	92.38	92.38	92.38	92.38	92.38	92.38	92.38	92.38	
Average = Sum(39) _{1...12} / 12 =												92.38	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	
Average = Sum(40) _{1...12} / 12 =												0.77	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

2.86 (42)

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

102.24 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$	112.46	108.37	104.28	100.19	96.1	92.02	92.02	96.1	100.19	104.28	108.37	112.46	
(44)m=	112.46	108.37	104.28	100.19	96.1	92.02	92.02	96.1	100.19	104.28	108.37	112.46	
Total = Sum(44) _{1...12} =												1226.87	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	166.78	145.87	150.52	131.23	125.92	108.66	100.69	115.54	116.92	136.26	148.74	161.52	
Total = Sum(45) _{1...12} =												1608.62	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	25.02	21.88	22.58	19.68	18.89	16.3	15.1	17.33	17.54	20.44	22.31	24.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03 (52)

Temperature factor from Table 2b

0.6 (53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03 (54)

Enter (50) or (54) in (55)

1.03 (55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	222.06	195.79	205.8	184.72	181.19	162.15	155.96	170.82	170.41	191.53	202.23	216.79	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	222.06	195.79	205.8	184.72	181.19	162.15	155.96	170.82	170.41	191.53	202.23	216.79	
Output from water heater (annual) ^{1...12}												2259.46	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	99.68	88.44	94.27	86.43	86.09	78.92	77.7	82.64	81.67	89.53	92.25	97.93	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	143.24	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	26.39	23.44	19.06	14.43	10.79	9.11	9.84	12.79	17.17	21.8	25.44	27.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	285.72	288.68	281.21	265.31	245.23	226.36	213.75	210.79	218.26	234.16	254.24	273.11	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	37.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	-114.59	(71)

Water heating gains (Table 5)

(72)m=	133.97	131.61	126.71	120.04	115.71	109.62	104.43	111.07	113.43	120.33	128.12	131.62	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	512.05	509.71	492.95	465.75	437.7	411.05	394	400.62	414.83	442.27	473.78	497.83	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	3.68	x	10.63	x	0.5	x	0.8	=	10.85	(74)
North	0.9x	0.77	x	5.06	x	10.63	x	0.5	x	0.8	=	14.91	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	3.68	x	20.32	x	0.5	x	0.8	=	20.73	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.5	x	0.8	=	28.5	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	3.68	x	34.53	x	0.5	x	0.8	=	35.22	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.5	x	0.8	=	48.43	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	3.68	x	55.46	x	0.5	x	0.8	=	56.58	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.5	x	0.8	=	77.8	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	3.68	x	74.72	x	0.5	x	0.8	=	76.22	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.5	x	0.8	=	104.8	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	3.68	x	79.99	x	0.5	x	0.8	=	81.59	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.5	x	0.8	=	112.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	3.68	x	74.68	x	0.5	x	0.8	=	76.18	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.5	x	0.8	=	104.74	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	3.68	x	59.25	x	0.5	x	0.8	=	60.44	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.5	x	0.8	=	83.1	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	3.68	x	41.52	x	0.5	x	0.8	=	42.35	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.5	x	0.8	=	58.23	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	3.68	x	24.19	x	0.5	x	0.8	=	24.68	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.5	x	0.8	=	33.93	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	3.68	x	13.12	x	0.5	x	0.8	=	13.38	(74)

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North	0.9x	0.77	x	5.06	x	13.12	x	0.5	x	0.8	=	18.4	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	3.68	x	8.86	x	0.5	x	0.8	=	9.04	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.5	x	0.8	=	12.43	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
South	0.9x	0.77	x	3.22	x	46.75	x	0.5	x	0.8	=	41.73	(78)
South	0.9x	0.77	x	3.22	x	76.57	x	0.5	x	0.8	=	68.34	(78)
South	0.9x	0.77	x	3.22	x	97.53	x	0.5	x	0.8	=	87.06	(78)
South	0.9x	0.77	x	3.22	x	110.23	x	0.5	x	0.8	=	98.39	(78)
South	0.9x	0.77	x	3.22	x	114.87	x	0.5	x	0.8	=	102.53	(78)
South	0.9x	0.77	x	3.22	x	110.55	x	0.5	x	0.8	=	98.67	(78)
South	0.9x	0.77	x	3.22	x	108.01	x	0.5	x	0.8	=	96.41	(78)
South	0.9x	0.77	x	3.22	x	104.89	x	0.5	x	0.8	=	93.63	(78)
South	0.9x	0.77	x	3.22	x	101.89	x	0.5	x	0.8	=	90.94	(78)
South	0.9x	0.77	x	3.22	x	82.59	x	0.5	x	0.8	=	73.71	(78)
South	0.9x	0.77	x	3.22	x	55.42	x	0.5	x	0.8	=	49.46	(78)
South	0.9x	0.77	x	3.22	x	40.4	x	0.5	x	0.8	=	36.06	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	83.76	148.67	223.55	317.64	397.87	414.85	391.6	327.82	255.05	169.33	101.32	71.1	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	595.82	658.38	716.5	783.39	835.57	825.9	785.6	728.44	669.88	611.6	575.1	568.93	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.89	0.7	0.51	0.58	0.85	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.3	20.47	20.7	20.9	20.99	21	21	20.94	20.7	20.4	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.28	20.28	20.28	20.28	20.28	20.28	20.28	20.28	20.28	20.28	20.28	20.28	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.96	0.85	0.63	0.43	0.49	0.8	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.2	19.34	19.59	19.92	20.18	20.27	20.28	20.28	20.24	19.92	19.49	19.16	(90)

fLA = Living area ÷ (4) =

0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.5	19.63	19.86	20.15	20.4	20.49	20.5	20.5	20.45	20.15	19.76	19.46	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.5	19.63	19.86	20.15	20.4	20.49	20.5	20.5	20.45	20.15	19.76	19.46	(93)

8. Space heating requirement

Set $T_{i,m}$ to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, h_m :

(94)m=	1	1	0.99	0.96	0.86	0.65	0.46	0.52	0.81	0.98	1	1	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	594.99	656.31	709.85	753.97	716.69	533.57	359.14	376.49	542.78	596.56	573.11	568.35	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	1404.32	1360.91	1233.86	1039.62	803.5	543.75	359.94	378.31	586.43	882.41	1169.99	1409.87	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	602.14	473.49	389.86	205.67	64.58	0	0	0	0	212.67	429.75	626.09	

Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$ 3004.26 (98)

Space heating requirement in $kWh/m^2/year$

24.95 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
3004.26

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 3154.47 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2259.46

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2372.43 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 55.27 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

77.9 (330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	77.9	(331)
Energy for lighting (calculated in Appendix L)		466.03	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1283.67 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 28.68 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1312.35 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1312.35 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 40.43 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 241.87 (379)
Total CO2, kg/year	sum of (376)...(382) =		1594.65 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		13.25 (384)
EI rating (section 14)			87.08 (385)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: a1-5-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	85.47 (1a) x	2.4 (2a) =	205.13 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	85.47 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.13 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0 +	0 +	0 =	0 x 40 =	0 (6a)
Number of open flues	0 +	0 +	0 =	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.2	= 2.52		(26)
Windows Type 1			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 2			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 3			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 4			5.06	x 1/[1/(1.2)+0.04]	= 5.79		(27)
Windows Type 5			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 6			0.01	x 1/[1/(1.2)+0.04]	= 0.01		(27)
Windows Type 7			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Walls Type1	50.79	18.87	31.92	x 0.18	= 5.75		(29)
Walls Type2	25.04	2.1	22.94	x 0.18	= 4.13		(29)
Total area of elements, m²			75.83				(31)
Party wall			25.74	x 0	= 0		(32)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 34 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.54 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

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Total fabric heat loss (33) + (36) = 41.54 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m × (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	75.39	75.39	75.39	75.39	75.39	75.39	75.39	75.39	75.39	75.39	75.39	75.39	
Average = Sum(39) _{1...12} /12=												75.39	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	
Average = Sum(40) _{1...12} /12=												0.88	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.56 (42)

if TFA > 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA -13.9)²)] + 0.0013 × (TFA -13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 × N) + 36 94.96 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c × (43)													
(44)m=	104.46	100.66	96.86	93.07	89.27	85.47	85.47	89.27	93.07	96.86	100.66	104.46	
Total = Sum(44) _{1...12} =												1139.57	(44)

Energy content of hot water used - calculated monthly = 4.190 × Vd,m × nm × DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	154.91	135.49	139.81	121.89	116.96	100.92	93.52	107.32	108.6	126.56	138.15	150.02	
Total = Sum(45) _{1...12} =												1494.16	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.24	20.32	20.97	18.28	17.54	15.14	14.03	16.1	16.29	18.98	20.72	22.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) × (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.19	185.41	195.09	175.38	172.23	154.42	148.8	162.59	162.09	181.84	191.65	205.3	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	210.19	185.41	195.09	175.38	172.23	154.42	148.8	162.59	162.09	181.84	191.65	205.3	
Output from water heater (annual) _{1, 12}												2145	(64)

Heat gains from water heating, kWh/month 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

(65)m=	95.73	84.99	90.71	83.32	83.11	76.35	75.32	79.9	78.9	86.3	88.73	94.1	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.55	18.25	14.84	11.24	8.4	7.09	7.66	9.96	13.37	16.97	19.81	21.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	230.49	232.88	226.86	214.03	197.83	182.61	172.44	170.04	176.07	188.9	205.1	220.32	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	(71)

Water heating gains (Table 5)

(72)m=	128.67	126.48	121.92	115.73	111.71	106.05	101.23	107.4	109.59	116	123.24	126.48	(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=	441.09	438.99	425	402.37	379.31	357.12	342.71	348.78	360.41	383.25	409.53	429.3	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d			Area m ²	Flux Table 6a			g_ Table 6b	FF Table 6c			Gains (W)	
North	0.9x	0.77	x	5.06	x	10.63	x	0.5	x	0.8	=	14.91	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.5	x	0.8	=	28.5	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.5	x	0.8	=	48.43	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.5	x	0.8	=	77.8	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.5	x	0.8	=	104.8	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.5	x	0.8	=	112.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.5	x	0.8	=	104.74	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.5	x	0.8	=	83.1	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.5	x	0.8	=	58.23	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.5	x	0.8	=	33.93	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.06	x	13.12	x	0.5	x	0.8	=	18.4	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.5	x	0.8	=	12.43	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
South	0.9x	0.77	x	0.01	x	46.75	x	0.5	x	0.8	=	0.13	(78)
South	0.9x	0.77	x	0.01	x	76.57	x	0.5	x	0.8	=	0.21	(78)
South	0.9x	0.77	x	0.01	x	97.53	x	0.5	x	0.8	=	0.27	(78)

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South	0.9x	0.77	x	0.01	x	110.23	x	0.5	x	0.8	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	114.87	x	0.5	x	0.8	=	0.32	(78)
South	0.9x	0.77	x	0.01	x	110.55	x	0.5	x	0.8	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	108.01	x	0.5	x	0.8	=	0.3	(78)
South	0.9x	0.77	x	0.01	x	104.89	x	0.5	x	0.8	=	0.29	(78)
South	0.9x	0.77	x	0.01	x	101.89	x	0.5	x	0.8	=	0.28	(78)
South	0.9x	0.77	x	0.01	x	82.59	x	0.5	x	0.8	=	0.23	(78)
South	0.9x	0.77	x	0.01	x	55.42	x	0.5	x	0.8	=	0.15	(78)
South	0.9x	0.77	x	0.01	x	40.4	x	0.5	x	0.8	=	0.11	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	76.39	147.99	246.77	374.77	479.02	500.6	472.28	391.35	290.94	175.81	94.83	63.18	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	517.48	586.98	671.76	777.14	858.33	857.72	814.99	740.13	651.35	559.06	504.36	492.48	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.76	0.56	0.41	0.47	0.75	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.14	20.27	20.5	20.77	20.95	20.99	21	21	20.96	20.72	20.37	20.1	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.71	0.49	0.33	0.38	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.03	19.22	19.55	19.92	20.13	20.18	20.18	20.18	20.16	19.86	19.36	18.98	(90)

fLA = Living area ÷ (4) =

0.4

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.47	19.64	19.93	20.26	20.46	20.5	20.51	20.51	20.48	20.2	19.76	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.47	19.64	19.93	20.26	20.46	20.5	20.51	20.51	20.48	20.2	19.76	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.73	0.51	0.36	0.42	0.71	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	515.48	581.8	653.39	699.66	625.48	441.53	294.37	308.94	459.59	529.1	499.9	491.06	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1143.97	1111.23	1012.2	856.66	660.24	445.11	294.7	309.72	480.83	723.67	954.71	1147.93	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	467.59	355.78	266.95	113.04	25.86	0	0	0	0	144.76	327.46	488.71	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

2190.15

(98)

Space heating requirement in kWh/m²/year

25.62

(99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

2190.15

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

2299.66 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2145

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2252.25 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

45.52 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

55.31 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

55.31 (331)

Energy for lighting (calculated in Appendix L)

362.89 (332)

12b. CO2 Emissions – Community heating scheme

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%)

If there is CHP using two fuels repeat (363) to (366) for the second fuel

93 (367a)

CO2 associated with heat source 1

[(307b)+(310b)] x 100 ÷ (367b) x

0.22

=

1057.22 (367)

Electrical energy for heat distribution

[(313) x

0.52

=

23.62 (372)

Total CO2 associated with community systems

(363)...(366) + (368)...(372)

=

1080.84 (373)

CO2 associated with space heating (secondary)

(309) x

0

=

0 (374)

CO2 associated with water from immersion heater or instantaneous heater

(312) x

0.22

=

0 (375)

Total CO2 associated with space and water heating

(373) + (374) + (375) =

1080.84 (376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	=	28.7	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	188.34	(379)
Total CO2, kg/year	sum of (376)...(382) =			1297.89	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.19	(384)
El rating (section 14)				86.67	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: a1-8-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	74.94 (1a) x	2.4 (2a) =	179.86 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.94 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	179.86 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 2			5.98	$\times 1/[1/(1.2) + 0.04]$	6.85		
Windows Type 3			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 4			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Walls Type1	41.4	14.26	27.14	0.18	4.89		
Walls Type2	10.58	2.1	8.48	0.18	1.53		
Total area of elements, m²			51.98				
Party wall			38.59	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 25.26 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.19 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.45 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68	29.68

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	67.12	67.12	67.12	67.12	67.12	67.12	67.12	67.12	67.12	67.12	67.12	67.12

Stroma FSAP 2012 Version: 1.0.4.12 (SAP 9.92) - <http://www.stroma.com> Average = Sum(39)_{1...12} /12= 67.12 (39)

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Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9		
Average = Sum(40) _{1...12} /12=												0.9	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.36

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

90.25

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	99.27	95.66	92.05	88.44	84.83	81.22	81.22	84.83	88.44	92.05	95.66	99.27	
Total = Sum(44) _{1...12} =												1082.96	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.22	128.76	132.87	115.83	111.15	95.91	88.88	101.99	103.2	120.27	131.29	142.57	
Total = Sum(45) _{1...12} =												1419.93	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.08	19.31	19.93	17.38	16.67	14.39	13.33	15.3	15.48	18.04	19.69	21.39	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.49	178.68	188.14	169.33	166.42	149.4	144.15	157.26	156.7	175.55	184.78	197.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.49	178.68	188.14	169.33	166.42	149.4	144.15	157.26	156.7	175.55	184.78	197.85	
Output from water heater (annual) _{1...12}												2070.77	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	93.17	82.75	88.4	81.31	81.18	74.69	73.77	78.13	77.11	84.21	86.45	91.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	117.99	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.61	16.53	13.44	10.17	7.61	6.42	6.94	9.02	12.1	15.37	17.94	19.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	208.54	210.71	205.25	193.64	178.99	165.22	156.01	153.85	159.3	170.91	185.57	199.34	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	34.8	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	-94.39	(71)

Water heating gains (Table 5)

(72)m=	125.23	123.15	118.82	112.93	109.11	103.73	99.16	105.02	107.1	113.19	120.07	123.15	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	410.78	408.77	395.91	375.15	354.1	333.76	320.51	326.28	336.9	357.87	381.97	400.02	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)		
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	5.98	x	10.63	x	0.5	x	0.8	=	17.63	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.98	x	20.32	x	0.5	x	0.8	=	33.69	(74)

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North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.98	x	34.53	x	0.5	x	0.8	=	57.24	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.98	x	55.46	x	0.5	x	0.8	=	91.94	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.98	x	74.72	x	0.5	x	0.8	=	123.85	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.98	x	79.99	x	0.5	x	0.8	=	132.59	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.98	x	74.68	x	0.5	x	0.8	=	123.79	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.98	x	59.25	x	0.5	x	0.8	=	98.21	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.98	x	41.52	x	0.5	x	0.8	=	68.82	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.98	x	24.19	x	0.5	x	0.8	=	40.1	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.98	x	13.12	x	0.5	x	0.8	=	21.74	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	5.98	x	8.86	x	0.5	x	0.8	=	14.69	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)

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East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	48.92	94.17	158.48	247.41	324.7	343.55	322.38	261.3	188.65	111.99	60.55	40.62	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	459.7	502.95	554.39	622.56	678.8	677.31	642.89	587.58	525.55	469.86	442.52	440.63	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.82	0.62	0.46	0.52	0.8	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.13	20.24	20.44	20.71	20.91	20.99	21	21	20.94	20.68	20.35	20.1	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.77	0.55	0.37	0.43	0.73	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19	19.16	19.45	19.83	20.09	20.16	20.17	20.17	20.13	19.8	19.33	18.95	(90)

fLA = Living area ÷ (4) =

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.45	19.59	19.85	20.18	20.42	20.49	20.5	20.5	20.45	20.15	19.74	19.41	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.45	19.59	19.85	20.18	20.42	20.49	20.5	20.5	20.45	20.15	19.74	19.41	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.93	0.79	0.57	0.41	0.47	0.76	0.96	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	457.82	499.05	543.09	578.69	535.86	389.44	261.28	273.86	397.96	449.19	438.66	439.22	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1017.16	986.13	895.93	757.16	585.2	395.53	261.89	275.23	426.52	641.19	848.29	1021	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	416.15	327.32	262.52	128.5	36.71	0	0	0	0	142.85	294.93	432.85	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = (98)

Space heating requirement in kWh/m²/year

(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)
<i>The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.</i>			
Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		kWh/year	
Annual space heating requirement		2041.83	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2143.92	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2070.77	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2174.31	(310a)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	43.18	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		48.49	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	48.49	(331)
Energy for lighting (calculated in Appendix L)		328.59	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	= 1002.94 (367)
Electrical energy for heat distribution	[(313) x	0.52	= 22.41 (372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)		= 1025.35 (373)
CO2 associated with space heating (secondary)	(309) x	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	= 0 (375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		1025.35 (376)
CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	= 25.17 (378)

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CO2 associated with electricity for lighting	(332))) x	0.52	=	170.54	(379)
Total CO2, kg/year	sum of (376)...(382) =			1221.06	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.29	(384)
El rating (section 14)				86.36	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: a1-8-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	85.47 (1a) x	2.4 (2a) =	205.13 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	85.47 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.13 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		(26)
Windows Type 1			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		(27)
Windows Type 2			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		(27)
Windows Type 3			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		(27)
Windows Type 4			5.06	$\times 1/[1/(1.2)+0.04]$	5.79		(27)
Windows Type 5			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		(27)
Windows Type 6			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		(27)
Windows Type 7			0.01	$\times 1/[1/(1.2)+0.04]$	0.01		(27)
Walls Type1	50.79	18.87	31.92	0.18	5.75		(29)
Walls Type2	25.04	2.1	22.94	0.18	4.13		(29)
Total area of elements, m²			75.83				(31)
Party wall			25.74	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 34 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.73 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 45.73 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m × (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	33.85	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	79.58	79.58	79.58	79.58	79.58	79.58	79.58	79.58	79.58	79.58	79.58	79.58	
Average = Sum(39) _{1...12} /12=												79.58	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	
Average = Sum(40) _{1...12} /12=												0.93	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.56 (42)

if TFA > 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA -13.9)²)] + 0.0013 × (TFA -13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 × N) + 36 94.96 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c × (43)													
(44)m=	104.46	100.66	96.86	93.07	89.27	85.47	85.47	89.27	93.07	96.86	100.66	104.46	
Total = Sum(44) _{1...12} =												1139.57	(44)

Energy content of hot water used - calculated monthly = 4.190 × Vd,m × nm × DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	154.91	135.49	139.81	121.89	116.96	100.92	93.52	107.32	108.6	126.56	138.15	150.02	
Total = Sum(45) _{1...12} =												1494.16	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.24	20.32	20.97	18.28	17.54	15.14	14.03	16.1	16.29	18.98	20.72	22.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) × (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.19	185.41	195.09	175.38	172.23	154.42	148.8	162.59	162.09	181.84	191.65	205.3	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	210.19	185.41	195.09	175.38	172.23	154.42	148.8	162.59	162.09	181.84	191.65	205.3	
Output from water heater (annual) _{1, 12}												2145	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	95.73	84.99	90.71	83.32	83.11	76.35	75.32	79.9	78.9	86.3	88.73	94.1	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	127.93	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.55	18.25	14.84	11.24	8.4	7.09	7.66	9.96	13.37	16.97	19.81	21.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	230.49	232.88	226.86	214.03	197.83	182.61	172.44	170.04	176.07	188.9	205.1	220.32	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	35.79	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	-102.34	(71)

Water heating gains (Table 5)

(72)m=	128.67	126.48	121.92	115.73	111.71	106.05	101.23	107.4	109.59	116	123.24	126.48	(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=	441.09	438.99	425	402.37	379.31	357.12	342.71	348.78	360.41	383.25	409.53	429.3	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d			Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	5.06	x	10.63	x	0.5	x	0.8	=	14.91	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.06	x	20.32	x	0.5	x	0.8	=	28.5	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.06	x	34.53	x	0.5	x	0.8	=	48.43	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.06	x	55.46	x	0.5	x	0.8	=	77.8	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.06	x	74.72	x	0.5	x	0.8	=	104.8	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.06	x	79.99	x	0.5	x	0.8	=	112.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.06	x	74.68	x	0.5	x	0.8	=	104.74	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.06	x	59.25	x	0.5	x	0.8	=	83.1	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.06	x	41.52	x	0.5	x	0.8	=	58.23	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.06	x	24.19	x	0.5	x	0.8	=	33.93	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.06	x	13.12	x	0.5	x	0.8	=	18.4	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	5.06	x	8.86	x	0.5	x	0.8	=	12.43	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
South	0.9x	0.77	x	0.01	x	46.75	x	0.5	x	0.8	=	0.13	(78)
South	0.9x	0.77	x	0.01	x	76.57	x	0.5	x	0.8	=	0.21	(78)
South	0.9x	0.77	x	0.01	x	97.53	x	0.5	x	0.8	=	0.27	(78)

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South	0.9x	0.77	x	0.01	x	110.23	x	0.5	x	0.8	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	114.87	x	0.5	x	0.8	=	0.32	(78)
South	0.9x	0.77	x	0.01	x	110.55	x	0.5	x	0.8	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	108.01	x	0.5	x	0.8	=	0.3	(78)
South	0.9x	0.77	x	0.01	x	104.89	x	0.5	x	0.8	=	0.29	(78)
South	0.9x	0.77	x	0.01	x	101.89	x	0.5	x	0.8	=	0.28	(78)
South	0.9x	0.77	x	0.01	x	82.59	x	0.5	x	0.8	=	0.23	(78)
South	0.9x	0.77	x	0.01	x	55.42	x	0.5	x	0.8	=	0.15	(78)
South	0.9x	0.77	x	0.01	x	40.4	x	0.5	x	0.8	=	0.11	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	76.39	147.99	246.77	374.77	479.02	500.6	472.28	391.35	290.94	175.81	94.83	63.18	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	517.48	586.98	671.76	777.14	858.33	857.72	814.99	740.13	651.35	559.06	504.36	492.48	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.79	0.58	0.43	0.49	0.77	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.07	20.2	20.44	20.73	20.93	20.99	21	21	20.95	20.67	20.31	20.03	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.14	20.14	20.14	20.14	20.14	20.14	20.14	20.14	20.14	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.91	0.73	0.51	0.35	0.4	0.7	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.89	19.09	19.42	19.83	20.07	20.13	20.14	20.14	20.1	19.76	19.24	18.84	(90)

fLA = Living area ÷ (4) =

0.4

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.36	19.53	19.83	20.19	20.41	20.48	20.48	20.48	20.44	20.12	19.67	19.32	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.36	19.53	19.83	20.19	20.41	20.48	20.48	20.48	20.44	20.12	19.67	19.32	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.91	0.75	0.54	0.38	0.44	0.73	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	515.53	582.07	654.96	707.71	645.28	461.87	308.49	323.56	474.83	532	500.13	491.08	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1198.79	1164.42	1060.61	898.16	693.41	467.64	309.07	324.9	504.6	757.99	1000.17	1202.95	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	508.34	391.34	301.8	137.12	35.81	0	0	0	0	168.14	360.03	529.63	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

2432.21

(98)

Space heating requirement in kWh/m²/year

28.46

(99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

2432.21

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

2553.82 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2145

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2252.25 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

48.06 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

55.31 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

55.31 (331)

Energy for lighting (calculated in Appendix L)

362.89 (332)

12b. CO2 Emissions – Community heating scheme

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%)

If there is CHP using two fuels repeat (363) to (366) for the second fuel

93 (367a)

CO2 associated with heat source 1

[(307b)+(310b)] x 100 ÷ (367b) x

0.22

=

1116.25 (367)

Electrical energy for heat distribution

[(313) x

0.52

=

24.94 (372)

Total CO2 associated with community systems

(363)...(366) + (368)...(372)

=

1141.19 (373)

CO2 associated with space heating (secondary)

(309) x

0

=

0 (374)

CO2 associated with water from immersion heater or instantaneous heater

(312) x

0.22

=

0 (375)

Total CO2 associated with space and water heating

(373) + (374) + (375) =

1141.19 (376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	=	28.7	(378)
CO2 associated with electricity for lighting	(332)) x	0.52	=	188.34	(379)
Total CO2, kg/year	sum of (376)...(382) =			1358.24	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.89	(384)
El rating (section 14)				86.05	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: a1-9-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	89.66 (1a) x	2.4 (2a) =	215.18 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	89.66 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.18 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.2	= 2.52		(26)
Windows Type 1			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 2			10.01	x 1/[1/(1.2)+0.04]	= 11.46		(27)
Windows Type 3			4.22	x 1/[1/(1.2)+0.04]	= 4.83		(27)
Windows Type 4			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 5			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Walls Type1	48.26	22.51	25.75	x 0.18	= 4.63		(29)
Walls Type2	18.56	2.1	16.46	x 0.18	= 2.96		(29)
Roof	89.66	0	89.66	x 0.11	= 9.86		(30)
Total area of elements, m²			156.48				(31)
Party wall			29.7	x 0	= 0		(32)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 45.76 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.93 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 61.69 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
35.51	35.51	35.51	35.51	35.51	35.51	35.51	35.51	35.51	35.51	35.51	35.51

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

97.19	97.19	97.19	97.19	97.19	97.19	97.19	97.19	97.19	97.19	97.19	97.19

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

97.19

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

1.08

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.62

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

96.45

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

106.09	102.24	98.38	94.52	90.66	86.8	86.8	90.66	94.52	98.38	102.24	106.09

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1157.4

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

157.34	137.61	142	123.8	118.79	102.5	94.98	109	110.3	128.54	140.31	152.37

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1517.53

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

23.6	20.64	21.3	18.57	17.82	15.38	14.25	16.35	16.54	19.28	21.05	22.86

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(56)

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

212.61	187.53	197.27	177.29	174.06	156	150.26	164.27	163.79	183.82	193.81	207.65

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

212.61	187.53	197.27	177.29	174.06	156	150.26	164.27	163.79	183.82	193.81	207.65

Output from water heater (annual) ^{1...12}	2168.37

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

96.54	85.7	91.44	83.96	83.72	76.88	75.8	80.46	79.47	86.96	89.45	94.88

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05	131.05

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

21.26	18.88	15.36	11.62	8.69	7.34	7.93	10.3	13.83	17.56	20.5	21.85

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

238.45	240.93	234.69	221.42	204.66	188.91	178.39	175.92	182.15	195.42	212.18	227.93

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11	36.11

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84	-104.84

 (71)

Water heating gains (Table 5)

(72)m=

129.75	127.52	122.9	116.61	112.52	106.77	101.89	108.15	110.37	116.88	124.23	127.53

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

451.78	449.65	435.26	411.96	388.19	365.34	350.52	356.68	368.67	392.18	419.23	439.63

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	10.01	x	10.63	x	0.5	x	0.8	=	29.51	(74)
North	0.9x	0.77	x	10.01	x	20.32	x	0.5	x	0.8	=	56.39	(74)
North	0.9x	0.77	x	10.01	x	34.53	x	0.5	x	0.8	=	95.81	(74)
North	0.9x	0.77	x	10.01	x	55.46	x	0.5	x	0.8	=	153.9	(74)
North	0.9x	0.77	x	10.01	x	74.72	x	0.5	x	0.8	=	207.32	(74)
North	0.9x	0.77	x	10.01	x	79.99	x	0.5	x	0.8	=	221.94	(74)
North	0.9x	0.77	x	10.01	x	74.68	x	0.5	x	0.8	=	207.21	(74)
North	0.9x	0.77	x	10.01	x	59.25	x	0.5	x	0.8	=	164.4	(74)
North	0.9x	0.77	x	10.01	x	41.52	x	0.5	x	0.8	=	115.2	(74)
North	0.9x	0.77	x	10.01	x	24.19	x	0.5	x	0.8	=	67.12	(74)
North	0.9x	0.77	x	10.01	x	13.12	x	0.5	x	0.8	=	36.4	(74)
North	0.9x	0.77	x	10.01	x	8.86	x	0.5	x	0.8	=	24.6	(74)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	4.22	x	19.64	x	0.5	x	0.8	=	22.97	(76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	4.22	x	38.42	x	0.5	x	0.8	=	44.94	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	4.22	x	63.27	x	0.5	x	0.8	=	74.02	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	4.22	x	92.28	x	0.5	x	0.8	=	107.95	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	4.22	x	113.09	x	0.5	x	0.8	=	132.29	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	4.22	x	115.77	x	0.5	x	0.8	=	135.43	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	4.22	x	110.22	x	0.5	x	0.8	=	128.93	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)

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East	0.9x	0.77	x	4.22	x	94.68	x	0.5	x	0.8	=	110.75	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	4.22	x	73.59	x	0.5	x	0.8	=	86.08	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	4.22	x	45.59	x	0.5	x	0.8	=	53.33	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	4.22	x	24.49	x	0.5	x	0.8	=	28.65	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	4.22	x	16.15	x	0.5	x	0.8	=	18.89	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	97.56	189.51	315.06	473.65	599.19	623.09	589.12	492.45	370.19	225.09	121.25	80.56	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	549.34	639.16	750.31	885.62	987.37	988.42	939.64	849.13	738.86	617.27	540.48	520.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.8	0.61	0.45	0.52	0.8	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.86	20.02	20.29	20.63	20.88	20.98	21	20.99	20.91	20.56	20.14	19.82	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.91	0.75	0.52	0.35	0.41	0.72	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.49	18.72	19.11	19.59	19.9	20	20.01	20.01	19.95	19.51	18.9	18.43	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.04	19.24	19.58	20.01	20.29	20.39	20.41	20.4	20.33	19.93	19.39	18.99	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

DER WorkSheet: New dwelling design stage

(93)m=	19.04	19.24	19.58	20.01	20.29	20.39	20.41	20.4	20.33	19.93	19.39	18.99	(93)

8. Space heating requirement

Set $T_{i,m}$ to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, h_m :

(94)m=	1	0.99	0.97	0.91	0.76	0.56	0.39	0.45	0.75	0.95	0.99	1	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	547.16	633.43	730.51	806.79	753.28	550	368.25	385.62	552.05	588.76	535.93	518.62	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	1432.59	1393.45	1271.52	1079.38	835.27	562.83	369.91	389.1	605.88	906.85	1194.91	1437.25	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	658.76	510.73	402.51	196.26	61.01	0	0	0	0	236.65	474.46	683.46	

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 3223.85 (98)

Space heating requirement in $kWh/m^2/year$

35.96 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
3223.85

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 3385.04 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2168.37

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2276.79 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 56.62 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

58.02 (330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	58.02	(331)
Energy for lighting (calculated in Appendix L)		375.42	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1315.01 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 29.38 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1344.39 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1344.39 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 30.11 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 194.85 (379)
Total CO2, kg/year	sum of (376)...(382) =		1569.35 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		17.5 (384)
EI rating (section 14)			84.38 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: a1-9-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	71.39 (1a) x	2.4 (2a) =	171.34 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.39 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.34 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			5.06	$\times 1/[1/(1.2)+0.04]$	5.79		
Windows Type 2			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 3			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 4			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Walls Type1	40.85	13.34	27.51	0.18	4.95		
Walls Type2	12.13	2.1	10.03	0.18	1.81		
Roof	71.39	0	71.39	0.11	7.85		
Total area of elements, m²			124.37				
Party wall			28.73	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 32.4 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.79 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 45.19 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=

28.27	28.27	28.27	28.27	28.27	28.27	28.27	28.27	28.27	28.27	28.27	28.27

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

73.46	73.46	73.46	73.46	73.46	73.46	73.46	73.46	73.46	73.46	73.46	73.46

Average = Sum(39)_{1...12} / 12 =

73.46

 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03

Average = Sum(40)_{1...12} / 12 =

1.03

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

2.28

 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

88.34

 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

97.17	93.64	90.1	86.57	83.04	79.5	79.5	83.04	86.57	90.1	93.64	97.17

Total = Sum(44)_{1...12} =

1060.03

 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

144.1	126.03	130.05	113.38	108.79	93.88	86.99	99.83	101.02	117.73	128.51	139.55

Total = Sum(45)_{1...12} =

1389.86

 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

21.61	18.9	19.51	17.01	16.32	14.08	13.05	14.97	15.15	17.66	19.28	20.93

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

 (48)

Temperature factor from Table 2b

0

 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110

 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

 (52)

Temperature factor from Table 2b

0.6

 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03

 (54)

Enter (50) or (54) in (55)

1.03

 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

DER WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.38	175.96	185.33	166.88	164.07	147.37	142.27	155.1	154.51	173	182	194.83

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=	199.38	175.96	185.33	166.88	164.07	147.37	142.27	155.1	154.51	173	182	194.83

Output from water heater (annual)_{1...12}

2040.7

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.13	81.85	87.46	80.49	80.4	74.01	73.15	77.41	76.38	83.37	85.52	90.62

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97	113.97

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.91	15.9	12.93	9.79	7.32	6.18	6.68	8.68	11.65	14.79	17.26	18.4

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.52	202.6	197.36	186.19	172.1	158.86	150.01	147.93	153.17	164.34	178.43	191.67

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4

(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18	-91.18

(71)

Water heating gains (Table 5)

(72)m=	123.84	121.8	117.56	111.8	108.06	102.79	98.32	104.05	106.09	112.05	118.78	121.8

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	399.45	397.49	385.04	364.97	344.67	325.02	312.2	317.85	328.1	348.37	371.67	389.07

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	5.06	x	19.64	x	0.5	x	0.8	=	27.55 (76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (76)

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East	0.9x	0.77	x	5.06	x	38.42	x	0.5	x	0.8	=	53.89	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	5.06	x	63.27	x	0.5	x	0.8	=	88.75	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	5.06	x	92.28	x	0.5	x	0.8	=	129.44	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	5.06	x	113.09	x	0.5	x	0.8	=	158.63	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	5.06	x	115.77	x	0.5	x	0.8	=	162.38	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	5.06	x	110.22	x	0.5	x	0.8	=	154.6	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	5.06	x	94.68	x	0.5	x	0.8	=	132.8	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	5.06	x	73.59	x	0.5	x	0.8	=	103.22	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	5.06	x	45.59	x	0.5	x	0.8	=	63.94	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	5.06	x	24.49	x	0.5	x	0.8	=	34.35	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	5.06	x	16.15	x	0.5	x	0.8	=	22.65	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)

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South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	114.11	200.44	286.4	368.71	420.92	420.11	404.19	365.73	315.42	225.19	137.88	96.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	513.56	597.94	671.44	733.69	765.59	745.13	716.39	683.59	643.52	573.56	509.55	485.9	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	1	0.99	0.97	0.91	0.79	0.61	0.45	0.49	0.73	0.94	0.99	1	

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.2	20.44	20.71	20.9	20.98	21	21	20.95	20.7	20.3	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.89	0.74	0.53	0.35	0.39	0.65	0.91	0.98	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.78	19.03	19.37	19.73	19.97	20.05	20.06	20.06	20.02	19.72	19.17	18.72	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.29	19.5	19.8	20.12	20.34	20.42	20.43	20.43	20.39	20.11	19.63	19.23	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.29	19.5	19.8	20.12	20.34	20.42	20.43	20.43	20.39	20.11	19.63	19.23	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.89	0.76	0.56	0.39	0.43	0.68	0.92	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	509.4	587.04	642.16	653.6	579.72	418.75	280.63	294.54	438.46	525.58	500.54	482.9	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1100.85	1072.31	976.82	824.27	634.64	427.58	281.64	296.24	462.38	698.85	920.13	1103.88	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	440.04	326.1	248.98	122.89	40.86	0	0	0	0	128.91	302.1	462.01	

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2071.9 (98)

Space heating requirement in kWh/m²/year

29.02 (99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

kWh/year

Annual space heating requirement

2071.9

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

2175.5 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2040.7

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2142.74 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

43.18 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

46.2 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

46.2 (331)

Energy for lighting (calculated in Appendix L)

316.23 (332)

12b. CO2 Emissions – Community heating scheme

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%)

If there is CHP using two fuels repeat (363) to (366) for the second fuel

93 (367a)

CO2 associated with heat source 1

[(307b)+(310b)] x 100 ÷ (367b) x

0.22

=

1002.95 (367)

Electrical energy for heat distribution

[(313) x

0.52

=

22.41 (372)

Total CO2 associated with community systems

(363)...(366) + (368)...(372)

=

1025.36 (373)

CO2 associated with space heating (secondary)

(309) x

0

=

0 (374)

CO2 associated with water from immersion heater or instantaneous heater

(312) x

0.22

=

0 (375)

Total CO2 associated with space and water heating

(373) + (374) + (375) =

1025.36 (376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	=	23.98	(378)
CO2 associated with electricity for lighting	(332)) x	0.52	=	164.12	(379)
Total CO2, kg/year	sum of (376)...(382) =			1213.46	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			17	(384)
El rating (section 14)				86.03	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: a1-9-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	74.1 (1a) x	2.4 (2a) =	177.84 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.1 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	177.84 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0 +	0 +	0 =	0 x 40 =	0 (6a)
Number of open flues	0 +	0 +	0 =	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		(26)
Windows Type 1			5.98	$\times 1/[1/(1.2) + 0.04]$	6.85		(27)
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 3			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 4			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		(27)
Windows Type 5			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Walls Type1	47.4	16.1	31.3	0.18	5.63		(29)
Walls Type2	26.78	2.1	24.68	0.18	4.44		(29)
Roof	74.1	0	74.1	0.11	8.15		(30)
Total area of elements, m²			148.28				(31)
Party wall			20.62	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 39.18 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 13.86 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 53.05 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

82.39	82.39	82.39	82.39	82.39	82.39	82.39	82.39	82.39	82.39	82.39	82.39

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

82.39

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

1.11

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.34

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

89.81

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

98.79	95.2	91.6	88.01	84.42	80.83	80.83	84.42	88.01	91.6	95.2	98.79

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1077.7

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

146.5	128.13	132.22	115.27	110.61	95.45	88.44	101.49	102.7	119.69	130.65	141.88

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1413.04

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

21.98	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.41	17.95	19.6	21.28

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(56)

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

201.78	178.06	187.5	168.77	165.88	148.94	143.72	156.77	156.2	174.97	184.15	197.16

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

201.78	178.06	187.5	168.77	165.88	148.94	143.72	156.77	156.2	174.97	184.15	197.16

Output from water heater (annual) _{1...12}	2063.88

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

92.93	82.55	88.18	81.12	81	74.53	73.63	77.97	76.94	84.02	86.24	91.4

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

18.42	16.36	13.31	10.08	7.53	6.36	6.87	8.93	11.99	15.22	17.76	18.94

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

206.67	208.82	203.41	191.91	177.38	163.73	154.61	152.47	157.87	169.38	183.9	197.55

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66

 (71)

Water heating gains (Table 5)

(72)m=

124.91	122.84	118.53	112.67	108.87	103.51	98.96	104.79	106.87	112.93	119.77	122.84

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

408.13	406.14	393.37	372.77	351.9	331.73	318.57	324.32	334.85	355.65	379.56	397.45

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	5.98	x	46.75	x	0.5	x	0.8	=	77.5	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	5.98	x	76.57	x	0.5	x	0.8	=	126.92	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	5.98	x	97.53	x	0.5	x	0.8	=	161.68	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	5.98	x	110.23	x	0.5	x	0.8	=	182.73	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	5.98	x	114.87	x	0.5	x	0.8	=	190.42	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	5.98	x	110.55	x	0.5	x	0.8	=	183.25	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	5.98	x	108.01	x	0.5	x	0.8	=	179.05	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	5.98	x	104.89	x	0.5	x	0.8	=	173.88	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	5.98	x	101.89	x	0.5	x	0.8	=	168.89	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	5.98	x	82.59	x	0.5	x	0.8	=	136.9	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	5.98	x	55.42	x	0.5	x	0.8	=	91.86	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	5.98	x	40.4	x	0.5	x	0.8	=	66.97	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	153.34	263.89	365.39	455.34	509.03	504.02	486.55	447.29	396.98	293.09	184.22	130.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	561.47	670.03	758.76	828.11	860.94	835.75	805.12	771.6	731.83	648.74	563.78	528.28	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.9	0.79	0.61	0.45	0.48	0.72	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.96	20.15	20.41	20.68	20.88	20.98	21	20.99	20.94	20.68	20.25	19.9	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.88	0.73	0.52	0.35	0.38	0.63	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.62	18.9	19.26	19.64	19.89	19.98	19.99	19.99	19.95	19.64	19.04	18.54	(90)

fLA = Living area ÷ (4) =

0.4	(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.15	19.4	19.72	20.06	20.29	20.38	20.39	20.39	20.35	20.05	19.52	19.09	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.15	19.4	19.72	20.06	20.29	20.38	20.39	20.39	20.35	20.05	19.52	19.09	(93)

8. Space heating requirement

Set $T_{i,m}$ to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, h_m :

(94)m=	0.99	0.98	0.95	0.88	0.75	0.56	0.39	0.42	0.67	0.9	0.98	0.99	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	555.98	654.73	718.87	727.2	642.21	464.33	310.99	326.48	486.78	586.35	551.84	524.37	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	1223.67	1194.4	1089.23	919.22	707.37	475.87	312.44	328.79	514.81	778.87	1023.58	1226.5	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	496.76	362.66	275.55	138.25	48.48	0	0	0	0	143.23	339.66	522.38	

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 2326.97 (98)

Space heating requirement in $kWh/m^2/year$

31.4 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2326.97

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 2443.31 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2063.88

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2167.07 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 46.1 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

47.95 (330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	47.95	(331)
Energy for lighting (calculated in Appendix L)		325.39	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1070.8 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 23.93 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1094.73 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1094.73 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 24.89 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 168.88 (379)
Total CO2, kg/year	sum of (376)...(382) =		1288.49 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		17.39 (384)
EI rating (section 14)			85.5 (385)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: a1-9-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	92.47 (1a) x	2.4 (2a) =	221.93 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.47 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	221.93 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		(26)
Windows Type 1			8.51	$\times 1/[1/(1.2) + 0.04]$	9.74		(27)
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 3			4.48	$\times 1/[1/(1.2) + 0.04]$	5.13		(27)
Windows Type 4			0.01	$\times 1/[1/(1.2) + 0.04]$	0.01		(27)
Windows Type 5			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 6			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 7			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Walls Type1	55.39	24.04	31.35	0.18	5.64		(29)
Walls Type2	33.78	2.1	31.68	0.18	5.7		(29)
Roof	92.47	0	92.47	0.11	10.17		(30)
Total area of elements, m²			181.64				(31)
Party wall			21.6	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 51.56 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 17.41 (36)

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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

68.98

(37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=	105.6	105.6	105.6	105.6	105.6	105.6	105.6	105.6	105.6	105.6	105.6	105.6

Average = Sum(39)_{1...12} / 12 =

105.6

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14

Average = Sum(40)_{1...12} / 12 =

1.14

(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.66

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

97.33

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	107.06	103.17	99.28	95.38	91.49	87.6	87.6	91.49	95.38	99.28	103.17	107.06

Total = Sum(44)_{1...12} =

1167.94

(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.77	138.86	143.29	124.92	119.87	103.44	95.85	109.99	111.3	129.71	141.59	153.76

Total = Sum(45)_{1...12} =

1531.36

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.82	20.83	21.49	18.74	17.98	15.52	14.38	16.5	16.7	19.46	21.24	23.06

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

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Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	214.05	188.79	198.57	178.42	175.15	156.93	151.13	165.27	164.8	184.99	195.09	209.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	214.05	188.79	198.57	178.42	175.15	156.93	151.13	165.27	164.8	184.99	195.09	209.04	
Output from water heater (annual) _{1, 12}												2182.2	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	97.01	86.11	91.87	84.33	84.08	77.19	76.09	80.79	79.8	87.35	89.87	95.35	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.71	19.28	15.68	11.87	8.88	7.49	8.1	10.52	14.13	17.94	20.93	22.32	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	243.55	246.08	239.71	226.15	209.03	192.95	182.2	179.68	186.04	199.6	216.72	232.8	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	-106.32	(71)

Water heating gains (Table 5)

(72)m=	130.39	128.14	123.48	117.13	113.01	107.21	102.27	108.59	110.84	117.41	124.83	128.15	(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=	458.53	456.38	441.74	418.02	393.79	370.52	355.44	361.66	373.88	397.82	425.35	446.14	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d			Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	8.51	x	10.63	x	0.5	x	0.8	=	25.08	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	8.51	x	20.32	x	0.5	x	0.8	=	47.94	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	8.51	x	34.53	x	0.5	x	0.8	=	81.46	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	8.51	x	55.46	x	0.5	x	0.8	=	130.84	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	8.51	x	74.72	x	0.5	x	0.8	=	176.25	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	8.51	x	79.99	x	0.5	x	0.8	=	188.68	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	8.51	x	74.68	x	0.5	x	0.8	=	176.16	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	8.51	x	59.25	x	0.5	x	0.8	=	139.76	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	8.51	x	41.52	x	0.5	x	0.8	=	97.94	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	8.51	x	24.19	x	0.5	x	0.8	=	57.06	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	8.51	x	13.12	x	0.5	x	0.8	=	30.94	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	8.51	x	8.86	x	0.5	x	0.8	=	20.91	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
South	0.9x	0.77	x	0.01	x	46.75	x	0.5	x	0.8	=	0.13	(78)
South	0.9x	0.77	x	0.01	x	76.57	x	0.5	x	0.8	=	0.21	(78)
South	0.9x	0.77	x	0.01	x	97.53	x	0.5	x	0.8	=	0.27	(78)

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South	0.9x	0.77	x	0.01	x	110.23	x	0.5	x	0.8	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	114.87	x	0.5	x	0.8	=	0.32	(78)
South	0.9x	0.77	x	0.01	x	110.55	x	0.5	x	0.8	=	0.31	(78)
South	0.9x	0.77	x	0.01	x	108.01	x	0.5	x	0.8	=	0.3	(78)
South	0.9x	0.77	x	0.01	x	104.89	x	0.5	x	0.8	=	0.29	(78)
South	0.9x	0.77	x	0.01	x	101.89	x	0.5	x	0.8	=	0.28	(78)
South	0.9x	0.77	x	0.01	x	82.59	x	0.5	x	0.8	=	0.23	(78)
South	0.9x	0.77	x	0.01	x	55.42	x	0.5	x	0.8	=	0.15	(78)
South	0.9x	0.77	x	0.01	x	40.4	x	0.5	x	0.8	=	0.11	(78)
West	0.9x	0.77	x	4.48	x	19.64	x	0.5	x	0.8	=	24.39	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	4.48	x	38.42	x	0.5	x	0.8	=	47.71	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	4.48	x	63.27	x	0.5	x	0.8	=	78.58	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	4.48	x	92.28	x	0.5	x	0.8	=	114.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	4.48	x	113.09	x	0.5	x	0.8	=	140.44	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	4.48	x	115.77	x	0.5	x	0.8	=	143.77	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	4.48	x	110.22	x	0.5	x	0.8	=	136.88	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	4.48	x	94.68	x	0.5	x	0.8	=	117.57	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	4.48	x	73.59	x	0.5	x	0.8	=	91.39	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	4.48	x	45.59	x	0.5	x	0.8	=	56.62	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	4.48	x	24.49	x	0.5	x	0.8	=	30.41	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	4.48	x	16.15	x	0.5	x	0.8	=	20.06	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	95.93	185.74	309.96	471.81	604.39	632.29	596.25	493.15	365.73	220.68	119.05	79.36	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	554.45	642.12	751.69	889.84	998.18	1002.81	951.69	854.81	739.61	618.49	544.4	525.5	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.83	0.64	0.48	0.55	0.83	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.77	19.92	20.2	20.56	20.84	20.97	20.99	20.99	20.88	20.5	20.06	19.73	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.77	0.55	0.37	0.44	0.75	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.33	18.55	18.95	19.45	19.82	19.95	19.96	19.96	19.87	19.38	18.75	18.27	(90)

fLA = Living area ÷ (4) =

0.4

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.9	19.1	19.45	19.89	20.23	20.35	20.38	20.37	20.28	19.83	19.27	18.85	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.9	19.1	19.45	19.89	20.23	20.35	20.38	20.37	20.28	19.83	19.27	18.85	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.92	0.79	0.59	0.42	0.48	0.78	0.96	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	552.43	637.04	734.78	822.11	787.6	587.6	395.87	413.5	575.66	594.23	540.3	524.02	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1542.04	1499.12	1367.1	1160.91	900.45	607.59	398.74	419.42	652.28	974.32	1285.39	1547.23	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	736.27	579.32	470.44	243.94	83.96	0	0	0	0	282.79	536.47	761.27	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

3694.45

(98)

Space heating requirement in kWh/m²/year

39.95

(99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

3694.45

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

3879.17 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2182.2

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2291.31 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

61.7 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

59.84 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

59.84 (331)

Energy for lighting (calculated in Appendix L)

383.45 (332)

12b. CO2 Emissions – Community heating scheme

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%)

If there is CHP using two fuels repeat (363) to (366) for the second fuel

93 (367a)

CO2 associated with heat source 1

[(307b)+(310b)] x 100 ÷ (367b) x

0.22

=

1433.14 (367)

Electrical energy for heat distribution

[(313) x

0.52

=

32.02 (372)

Total CO2 associated with community systems

(363)...(366) + (368)...(372)

=

1465.17 (373)

CO2 associated with space heating (secondary)

(309) x

0

=

0 (374)

CO2 associated with water from immersion heater or instantaneous heater

(312) x

0.22

=

0 (375)

Total CO2 associated with space and water heating

(373) + (374) + (375) =

1465.17 (376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	31.06	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	199.01	(379)
Total CO2, kg/year	sum of (376)...(382) =			1695.23	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.33	(384)
El rating (section 14)				83.48	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-10-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	54.19 (1a)	2.4 (2a)	130.06 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54.19 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	130.06 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	0.85 (20)

Infiltration rate incorporating shelter factor	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		(26)
Windows Type 1			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 2			4.6	$\times 1/[1/(1.2) + 0.04]$	5.27		(27)
Windows Type 3			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 4			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 5			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Walls Type1	40.99	15.64	25.35	0.18	4.56		(29)
Walls Type2	24.59	2.1	22.49	0.18	4.05		(29)
Roof	54.19	0	54.19	0.11	5.96		(30)
Total area of elements, m²			119.77				(31)
Party wall			16.4	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 35 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 50.36 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
21.46	21.46	21.46	21.46	21.46	21.46	21.46	21.46	21.46	21.46	21.46	21.46

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

71.82	71.82	71.82	71.82	71.82	71.82	71.82	71.82	71.82	71.82	71.82	71.82

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

71.82

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

1.33

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

1.81

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

77.27

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

85	81.91	78.82	75.73	72.64	69.55	69.55	72.64	75.73	78.82	81.91	85

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

927.27

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

126.05	110.25	113.76	99.18	95.17	82.12	76.1	87.32	88.37	102.98	112.41	122.08

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1215.8

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

18.91	16.54	17.06	14.88	14.28	12.32	11.41	13.1	13.26	15.45	16.86	18.31

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(56)

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

181.33	160.17	169.04	152.68	150.44	135.62	131.38	142.6	141.86	158.26	165.91	177.35

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

181.33	160.17	169.04	152.68	150.44	135.62	131.38	142.6	141.86	158.26	165.91	177.35

Output from water heater (annual) ^{1...12}	1866.64

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

86.13	76.6	82.05	75.77	75.86	70.1	69.52	73.26	72.18	78.46	80.17	84.81

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

14.09	12.52	10.18	7.71	5.76	4.86	5.26	6.83	9.17	11.64	13.59	14.49

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

158.1	159.74	155.6	146.8	135.69	125.25	118.27	116.63	120.77	129.57	140.68	151.12

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07	32.07

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54	-72.54

 (71)

Water heating gains (Table 5)

(72)m=

115.77	113.99	110.28	105.24	101.97	97.36	93.45	98.46	100.25	105.46	111.35	113.99

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

338.17	336.44	326.27	309.95	293.63	277.68	267.18	272.13	280.39	296.88	315.82	329.8

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)

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North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
East	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(76)
East	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)
East	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)
East	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	57.58	111.18	186.35	287.41	372.86	392.4	369.07	302.03	220.89	132.16	71.37	47.72	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	395.75	447.62	512.62	597.36	666.48	670.08	636.25	574.17	501.27	429.04	387.19	377.53	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.82	0.64	0.49	0.55	0.81	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.65	19.8	20.09	20.48	20.79	20.95	20.99	20.98	20.85	20.44	19.97	19.61	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.82	19.82	19.82	19.82	19.82	19.82	19.82	19.82	19.82	19.82	19.82	19.82	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.91	0.76	0.54	0.36	0.42	0.73	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.05	18.27	18.69	19.23	19.63	19.79	19.82	19.81	19.71	19.19	18.51	17.99	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.85	19.04	19.39	19.85	20.21	20.37	20.4	20.4	20.28	19.81	19.24	18.8	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.85	19.04	19.39	19.85	20.21	20.37	20.4	20.4	20.28	19.81	19.24	18.8	(93)

8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, h_m :

(94)m=	0.99	0.99	0.97	0.91	0.78	0.59	0.42	0.49	0.77	0.94	0.99	0.99	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	392.6	441.24	495.91	543.83	520.55	394.73	269.6	280.52	383.49	405.32	381.52	375.06	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	1044.79	1015.44	925.99	786.65	611.44	414.38	273.12	287.03	443.91	661.79	872.01	1048.27	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	485.23	385.86	319.97	174.83	67.62	0	0	0	0	190.82	353.15	500.87	

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 2478.36 (98)

Space heating requirement in $kWh/m^2/year$

45.73 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2478.36

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 2602.28 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

1866.64

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 1959.97 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 45.62 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

35.07 (330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	35.07	(331)
Energy for lighting (calculated in Appendix L)		248.91	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1059.62 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 23.68 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1083.3 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1083.3 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 18.2 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 129.18 (379)
Total CO2, kg/year	sum of (376)...(382) =		1230.68 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		22.71 (384)
EI rating (section 14)			83.37 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-10-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	88.34 (1a) x	2.4 (2a) =	212.02 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	88.34 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	212.02 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.2	= 2.52		(26)
Windows Type 1			2.76	x 1/[1/(1.2) + 0.04]	= 3.16		(27)
Windows Type 2			2.82	x 1/[1/(1.2) + 0.04]	= 3.23		(27)
Windows Type 3			2.76	x 1/[1/(1.2) + 0.04]	= 3.16		(27)
Windows Type 4			1.84	x 1/[1/(1.2) + 0.04]	= 2.11		(27)
Windows Type 5			5.29	x 1/[1/(1.2) + 0.04]	= 6.06		(27)
Windows Type 6			2.76	x 1/[1/(1.2) + 0.04]	= 3.16		(27)
Windows Type 7			2.76	x 1/[1/(1.2) + 0.04]	= 3.16		(27)
Walls Type1	69.04	20.99	48.05	x 0.18	= 8.65		(29)
Walls Type2	36.6	2.1	34.5	x 0.18	= 6.21		(29)
Roof	88.34	0	88.34	x 0.11	= 9.72		(30)
Total area of elements, m²			193.98				(31)
Party wall			21.68	x 0	= 0		(32)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 51.13 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 19.2 (36)

DER WorkSheet: New dwelling design stage

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

70.33

(37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	34.98	34.98	34.98	34.98	34.98	34.98	34.98	34.98	34.98	34.98	34.98	34.98

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=	105.31	105.31	105.31	105.31	105.31	105.31	105.31	105.31	105.31	105.31	105.31	105.31

Average = Sum(39)_{1...12} / 12 =

105.31

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19

Average = Sum(40)_{1...12} / 12 =

1.19

(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.6

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

96

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	105.61	101.77	97.92	94.08	90.24	86.4	86.4	90.24	94.08	97.92	101.77	105.61

Total = Sum(44)_{1...12} =

1152.06

(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	156.61	136.97	141.34	123.23	118.24	102.03	94.55	108.49	109.79	127.95	139.67	151.67

Total = Sum(45)_{1...12} =

1510.53

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.49	20.55	21.2	18.48	17.74	15.3	14.18	16.27	16.47	19.19	20.95	22.75

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.89	186.9	196.62	176.72	173.52	155.52	149.82	163.77	163.28	183.23	193.16	206.94	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.89	186.9	196.62	176.72	173.52	155.52	149.82	163.77	163.28	183.23	193.16	206.94	
Output from water heater (annual) _{1, 12}												2161.37	(64)

Heat gains from water heating, kWh/month 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

(65)m=	96.29	85.49	91.22	83.77	83.54	76.72	75.66	80.3	79.3	86.76	89.23	94.65	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	130.12	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.04	18.69	15.2	11.5	8.6	7.26	7.85	10.2	13.69	17.38	20.28	21.62	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	235.99	238.44	232.27	219.13	202.55	186.96	176.55	174.1	180.27	193.41	209.99	225.58	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	-104.09	(71)

Water heating gains (Table 5)

(72)m=	129.43	127.21	122.6	116.34	112.28	106.56	101.69	107.92	110.14	116.62	123.94	127.22	(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=	448.49	446.37	432.1	409.01	385.46	362.81	348.12	354.26	366.13	389.44	416.25	436.46	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	5.29	x	46.75	x	0.5	x	0.8	=	68.56	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	5.29	x	76.57	x	0.5	x	0.8	=	112.28	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	5.29	x	97.53	x	0.5	x	0.8	=	143.02	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	5.29	x	110.23	x	0.5	x	0.8	=	161.65	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	5.29	x	114.87	x	0.5	x	0.8	=	168.45	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	5.29	x	110.55	x	0.5	x	0.8	=	162.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	5.29	x	108.01	x	0.5	x	0.8	=	158.39	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	5.29	x	104.89	x	0.5	x	0.8	=	153.82	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	5.29	x	101.89	x	0.5	x	0.8	=	149.4	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	5.29	x	82.59	x	0.5	x	0.8	=	121.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	5.29	x	55.42	x	0.5	x	0.8	=	81.26	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
South	0.9x	0.77	x	5.29	x	40.4	x	0.5	x	0.8	=	59.24	(78)
West	0.9x	0.77	x	2.82	x	19.64	x	0.5	x	0.8	=	15.35	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.82	x	38.42	x	0.5	x	0.8	=	30.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.82	x	63.27	x	0.5	x	0.8	=	49.46	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.82	x	92.28	x	0.5	x	0.8	=	72.14	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.82	x	113.09	x	0.5	x	0.8	=	88.41	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.82	x	115.77	x	0.5	x	0.8	=	90.5	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.82	x	110.22	x	0.5	x	0.8	=	86.16	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.82	x	94.68	x	0.5	x	0.8	=	74.01	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.82	x	73.59	x	0.5	x	0.8	=	57.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.82	x	45.59	x	0.5	x	0.8	=	35.64	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	2.82	x	24.49	x	0.5	x	0.8	=	19.14	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.82	x	16.15	x	0.5	x	0.8	=	12.63	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	188.6	328.13	462.08	586.15	662.9	659.28	635.25	578.88	505.75	366.68	227.28	160.45	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	637.09	774.5	894.18	995.16	1048.36	1022.1	983.37	933.14	871.88	756.12	643.52	596.9	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.91	0.8	0.63	0.46	0.51	0.75	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.81	20.02	20.3	20.62	20.85	20.97	20.99	20.99	20.92	20.6	20.13	19.76	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.89	0.74	0.54	0.35	0.4	0.66	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.36	18.66	19.07	19.5	19.79	19.9	19.92	19.92	19.87	19.48	18.82	18.29	(90)

fLA = Living area ÷ (4) =

0.4

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.94	19.2	19.56	19.94	20.22	20.33	20.35	20.35	20.29	19.93	19.34	18.88	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.94	19.2	19.56	19.94	20.22	20.33	20.35	20.35	20.29	19.93	19.34	18.88	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.89	0.76	0.57	0.4	0.44	0.69	0.92	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	632.08	759.59	852.68	883.41	796.14	583.61	392.34	411.42	603.3	694.38	632.51	593.37	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1542.03	1506.24	1375.36	1163.06	896.74	603.33	395.11	415.92	651.79	982.3	1289.29	1545.51	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	677.01	501.75	388.87	201.35	74.85	0	0	0	0	214.21	472.88	708.39	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

3239.31

(98)

Space heating requirement in kWh/m²/year

36.67

(99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

kWh/year

Annual space heating requirement

3239.31

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

3401.28 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2161.37

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2269.44 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

56.71 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

57.16 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

57.16 (331)

Energy for lighting (calculated in Appendix L)

371.55 (332)

12b. CO2 Emissions – Community heating scheme

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%)

If there is CHP using two fuels repeat (363) to (366) for the second fuel

93 (367a)

CO2 associated with heat source 1

[(307b)+(310b)] x 100 ÷ (367b) x

0.22

=

1317.07 (367)

Electrical energy for heat distribution

[(313) x

0.52

=

29.43 (372)

Total CO2 associated with community systems

(363)...(366) + (368)...(372)

=

1346.5 (373)

CO2 associated with space heating (secondary)

(309) x

0

=

0 (374)

CO2 associated with water from immersion heater or instantaneous heater

(312) x

0.22

=

0 (375)

Total CO2 associated with space and water heating

(373) + (374) + (375) =

1346.5 (376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	=	29.67	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	192.83	(379)
Total CO2, kg/year	sum of (376)...(382) =			1569	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			17.76	(384)
El rating (section 14)				84.23	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-10-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	74.36 (1a) x	2.4 (2a) =	178.46 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.36 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	178.46 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) (9)

Additional infiltration [(9)-1]x0.1 = (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 (12)

If no draught lobby, enter 0.05, else enter 0 (13)

Percentage of windows and doors draught stripped (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered (19)

Shelter factor (20) = 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		(26)
Windows Type 1			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		(27)
Windows Type 2			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		(27)
Windows Type 3			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		(27)
Windows Type 4			5.48	$\times 1/[1/(1.2)+0.04]$	6.27		(27)
Windows Type 5			1.84	$\times 1/[1/(1.2)+0.04]$	2.11		(27)
Windows Type 6			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		(27)
Walls Type1	39.66	18.36	21.3	0.18	3.83		(29)
Walls Type2	16.48	2.1	14.38	0.18	2.59		(29)
Roof	74.36	0	74.36	0.11	8.18		(30)
Total area of elements, m²			130.5				(31)
Party wall			37.04	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 38.14 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 54.15 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m × (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.45	29.45	29.45	29.45	29.45	29.45	29.45	29.45	29.45	29.45	29.45	29.45	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	83.6	83.6	83.6	83.6	83.6	83.6	83.6	83.6	83.6	83.6	83.6	83.6	
Average = Sum(39) _{1...12} /12=												83.6	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	
Average = Sum(40) _{1...12} /12=												1.12	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.35 (42)

if TFA > 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA -13.9)²)] + 0.0013 × (TFA -13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 × N) + 36 89.95 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c × (43)													

(44)m=	98.94	95.34	91.74	88.15	84.55	80.95	80.95	84.55	88.15	91.74	95.34	98.94	
Total = Sum(44) _{1...12} =												1079.34	(44)

Energy content of hot water used - calculated monthly = 4.190 × Vd,m × nm × DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.72	128.33	132.42	115.45	110.78	95.59	88.58	101.65	102.86	119.87	130.85	142.09	
Total = Sum(45) _{1...12} =												1415.19	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.01	19.25	19.86	17.32	16.62	14.34	13.29	15.25	15.43	17.98	19.63	21.31	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) × (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202	178.25	187.7	168.94	166.05	149.08	143.86	156.92	156.35	175.15	184.34	197.37	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202	178.25	187.7	168.94	166.05	149.08	143.86	156.92	156.35	175.15	184.34	197.37	
Output from water heater (annual) _{1, 12}												2066.03	(64)

Heat gains from water heating, kWh/month 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

(65)m=	93.01	82.61	88.25	81.18	81.05	74.58	73.67	78.02	77	84.08	86.3	91.47	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	117.36	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.48	16.41	13.35	10.1	7.55	6.38	6.89	8.96	12.02	15.26	17.81	18.99	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	207.25	209.4	203.98	192.45	177.88	164.19	155.05	152.9	158.32	169.86	184.42	198.11	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	-93.89	(71)

Water heating gains (Table 5)

(72)m=	125.01	122.93	118.62	112.75	108.94	103.58	99.02	104.86	106.94	113.01	119.86	122.94	(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=	408.95	406.95	394.15	373.51	352.59	332.36	319.17	324.93	335.48	356.34	380.31	398.25	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
North	0.9x	5.48	10.63	0.5	0.8	16.15 (74)
North	0.9x	5.48	20.32	0.5	0.8	30.87 (74)
North	0.9x	5.48	34.53	0.5	0.8	52.45 (74)
North	0.9x	5.48	55.46	0.5	0.8	84.25 (74)
North	0.9x	5.48	74.72	0.5	0.8	113.5 (74)
North	0.9x	5.48	79.99	0.5	0.8	121.5 (74)
North	0.9x	5.48	74.68	0.5	0.8	113.44 (74)
North	0.9x	5.48	59.25	0.5	0.8	90 (74)
North	0.9x	5.48	41.52	0.5	0.8	63.07 (74)
North	0.9x	5.48	24.19	0.5	0.8	36.75 (74)
North	0.9x	5.48	13.12	0.5	0.8	19.93 (74)
North	0.9x	5.48	8.86	0.5	0.8	13.47 (74)
West	0.9x	2.76	19.64	0.5	0.8	15.03 (80)
West	0.9x	2.76	19.64	0.5	0.8	15.03 (80)
West	0.9x	2.76	19.64	0.5	0.8	15.03 (80)
West	0.9x	1.84	19.64	0.5	0.8	10.02 (80)
West	0.9x	2.76	19.64	0.5	0.8	15.03 (80)
West	0.9x	2.76	38.42	0.5	0.8	29.39 (80)
West	0.9x	2.76	38.42	0.5	0.8	29.39 (80)
West	0.9x	2.76	38.42	0.5	0.8	29.39 (80)
West	0.9x	1.84	38.42	0.5	0.8	19.6 (80)
West	0.9x	2.76	38.42	0.5	0.8	29.39 (80)
West	0.9x	2.76	63.27	0.5	0.8	48.41 (80)
West	0.9x	2.76	63.27	0.5	0.8	48.41 (80)
West	0.9x	2.76	63.27	0.5	0.8	48.41 (80)
West	0.9x	1.84	63.27	0.5	0.8	32.27 (80)
West	0.9x	2.76	63.27	0.5	0.8	48.41 (80)
West	0.9x	2.76	92.28	0.5	0.8	70.6 (80)
West	0.9x	2.76	92.28	0.5	0.8	70.6 (80)
West	0.9x	2.76	92.28	0.5	0.8	70.6 (80)
West	0.9x	1.84	92.28	0.5	0.8	47.07 (80)
West	0.9x	2.76	92.28	0.5	0.8	70.6 (80)
West	0.9x	2.76	113.09	0.5	0.8	86.52 (80)
West	0.9x	2.76	113.09	0.5	0.8	86.52 (80)
West	0.9x	2.76	113.09	0.5	0.8	86.52 (80)
West	0.9x	1.84	113.09	0.5	0.8	57.68 (80)
West	0.9x	2.76	113.09	0.5	0.8	86.52 (80)
West	0.9x	2.76	115.77	0.5	0.8	88.57 (80)
West	0.9x	2.76	115.77	0.5	0.8	88.57 (80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 86.28 168.04 278.36 413.72 517.28 534.84 506.95 428.02 325.8 199.51 107.36 71.13 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 495.22 575 672.51 787.23 869.86 867.2 826.12 752.95 661.29 555.85 487.67 469.38 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(86)m=	1	0.99	0.98	0.92	0.79	0.6	0.44	0.5	0.77	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.85	20.02	20.3	20.64	20.88	20.98	21	20.99	20.92	20.57	20.14	19.81	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.73	0.51	0.34	0.4	0.69	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.46	18.7	19.1	19.57	19.87	19.97	19.98	19.98	19.92	19.5	18.88	18.4	(90)

fLA = Living area ÷ (4) =	0.4	(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.02	19.22	19.58	20	20.28	20.37	20.39	20.38	20.32	19.93	19.38	18.96	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.02	19.22	19.58	20	20.28	20.37	20.39	20.38	20.32	19.93	19.38	18.96	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.9	0.75	0.54	0.38	0.44	0.72	0.94	0.99	1	(94)

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	492.4	567.92	649.83	706.06	649.38	471.47	315.06	330.15	477.77	523.56	481.94	467.31	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm, W = [(39)m × ((93)m – (96)m)]

(97)m=	1230.41	1197.44	1093.24	927.7	716.92	482.41	316.5	333.02	519.88	779.82	1026.76	1234.2	(97)

Space heating requirement for each month, kWh/month = 0.024 × [(97)m – (95)m] × (41)m

(98)m=	549.08	423.03	329.9	159.58	50.25	0	0	0	0	190.66	392.27	570.57	

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	2665.34	(98)

Space heating requirement in kWh/m²/year

35.84	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)

Fraction of space heat from community system 1 – (301) =

1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1	(303a)

Fraction of total space heat from Community boilers

(302) × (303a) =	1	(304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)

Distribution loss factor (Table 12c) for community heating system

1.05	(306)

Space heating

Annual space heating requirement

kWh/year	
2665.34	

DER WorkSheet: New dwelling design stage

Space heat from Community boilers	$(98) \times (304a) \times (305) \times (306) =$	2798.61	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)

Water heating

Annual water heating requirement		2066.03	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	2169.33	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	49.68	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		48.12	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	48.12	(331)
Energy for lighting (calculated in Appendix L)		326.3	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1153.84 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 25.78 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1179.63 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1179.63 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 24.97 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 169.35 (379)
Total CO2, kg/year	sum of (376)...(382) =		1373.95 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		18.48 (384)
El rating (section 14)			84.58 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-2-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	86.14 (1a) x	2.4 (2a) =	206.74 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.14 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	206.74 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0 +	0 +	0 =	0 x 40 =	0 (6a)
Number of open flues	0 +	0 +	0 =	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		(26)
Windows Type 1			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 2			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		(27)
Windows Type 3			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		(27)
Windows Type 4			8.05	$\times 1/[1/(1.2) + 0.04]$	9.22		(27)
Windows Type 5			5.29	$\times 1/[1/(1.2) + 0.04]$	6.06		(27)
Floor			86.14	0.11	9.4754		(28)
Walls Type1	44.62	19.78	24.84	0.18	4.47		(29)
Walls Type2	5.87	2.1	3.77	0.18	0.68		(29)
Total area of elements, m²			136.63				(31)
Party wall			44.11	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 39.79 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.68 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 51.47 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

85.58	85.58	85.58	85.58	85.58	85.58	85.58	85.58	85.58	85.58	85.58	85.58

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

85.58

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

0.99

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.57

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

95.22

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
104.74	100.93	97.12	93.31	89.5	85.69	85.69	89.5	93.31	97.12	100.93	104.74

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1142.6

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

155.32	135.85	140.18	122.21	117.27	101.19	93.77	107.6	108.89	126.9	138.52	150.42

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1498.13

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

23.3	20.38	21.03	18.33	17.59	15.18	14.07	16.14	16.33	19.03	20.78	22.56

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(56)

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

210.6	185.77	195.46	175.71	172.54	154.69	149.05	162.88	162.38	182.17	192.01	205.7

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

210.6	185.77	195.46	175.71	172.54	154.69	149.05	162.88	162.38	182.17	192.01	205.7

Output from water heater (annual) ^{1...12}	2148.97

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

95.87	85.11	90.83	83.43	83.21	76.44	75.4	80	79	86.42	88.85	94.24

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

20.66	18.35	14.93	11.3	8.45	7.13	7.71	10.02	13.44	17.07	19.92	21.24

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

231.79	234.2	228.14	215.23	198.95	183.64	173.41	171	177.07	189.97	206.26	221.57

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76

 (71)

Water heating gains (Table 5)

(72)m=

128.85	126.65	122.09	115.88	111.85	106.17	101.34	107.53	109.72	116.15	123.41	126.66

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

442.85	440.74	426.69	403.95	380.78	358.47	344	350.08	361.77	384.73	411.12	431.01

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)

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North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
East	0.9x	0.77	x	8.05	x	19.64	x	0.5	x	0.8	=	43.83	(76)
East	0.9x	0.77	x	8.05	x	38.42	x	0.5	x	0.8	=	85.73	(76)
East	0.9x	0.77	x	8.05	x	63.27	x	0.5	x	0.8	=	141.19	(76)
East	0.9x	0.77	x	8.05	x	92.28	x	0.5	x	0.8	=	205.92	(76)
East	0.9x	0.77	x	8.05	x	113.09	x	0.5	x	0.8	=	252.36	(76)
East	0.9x	0.77	x	8.05	x	115.77	x	0.5	x	0.8	=	258.34	(76)
East	0.9x	0.77	x	8.05	x	110.22	x	0.5	x	0.8	=	245.95	(76)
East	0.9x	0.77	x	8.05	x	94.68	x	0.5	x	0.8	=	211.27	(76)
East	0.9x	0.77	x	8.05	x	73.59	x	0.5	x	0.8	=	164.21	(76)
East	0.9x	0.77	x	8.05	x	45.59	x	0.5	x	0.8	=	101.73	(76)
East	0.9x	0.77	x	8.05	x	24.49	x	0.5	x	0.8	=	54.65	(76)
East	0.9x	0.77	x	8.05	x	16.15	x	0.5	x	0.8	=	36.04	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	78.4	151.81	253.47	386.27	495.3	518.41	488.76	403.91	299.2	180.38	97.3	64.86	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.25	592.55	680.16	790.21	876.08	876.89	832.76	753.99	660.97	565.11	508.42	495.87	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.94	0.81	0.61	0.45	0.52	0.8	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.98	20.12	20.36	20.67	20.9	20.98	21	20.99	20.93	20.62	20.23	19.94	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.75	0.53	0.36	0.42	0.72	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.72	18.92	19.27	19.71	19.99	20.08	20.09	20.09	20.03	19.64	19.09	18.67	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.23	19.4	19.71	20.09	20.36	20.44	20.45	20.45	20.39	20.03	19.55	19.18	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.23	19.4	19.71	20.09	20.36	20.44	20.45	20.45	20.39	20.03	19.55	19.18	(93)

8. Space heating requirement

Set $T_{i,m}$ to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, h_m :

(94)m=	1	0.99	0.98	0.92	0.77	0.56	0.39	0.46	0.75	0.96	0.99	1	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	519.31	587.8	664.33	725.78	675.03	490.68	328.59	344.28	496.48	540.28	504.36	494.46	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]]$

(97)m=	1277.35	1240.8	1130.3	957.91	740.87	499.82	329.64	346.6	538.49	807.26	1065.37	1281.79	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	563.98	438.82	346.68	167.13	48.98	0	0	0	0	198.64	403.93	585.77	

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 2753.93 (98)

Space heating requirement in $kWh/m^2/year$

31.97 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2753.93

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

2891.62 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2148.97

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2256.41 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$

51.48 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

55.74 (330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	55.74	(331)
Energy for lighting (calculated in Appendix L)		364.94	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1195.67 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 26.72 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1222.39 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1222.39 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 28.93 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 189.41 (379)
Total CO2, kg/year	sum of (376)...(382) =		1440.73 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		16.73 (384)
EI rating (section 14)			85.28 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-2-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	71.42 (1a) x	2.4 (2a) =	171.41 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.42 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.41 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 3			4.6	$\times 1/[1/(1.2) + 0.04]$	5.27		
Floor			71.42	0.11	7.8562		
Walls Type1	28.74	10.12	18.62	0.18	3.35		
Walls Type2	43.06	2.1	40.96	0.18	7.37		
Total area of elements, m²			143.22				
Party wall			14.79	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 32.69 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.85 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 72.13 72.13 72.13 72.13 72.13 72.13 72.13 72.13 72.13 72.13 72.13 72.13 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	
Average = Sum(40) _{1...12} /12=													1.01 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.28

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

88.35

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.19	93.65	90.12	86.59	83.05	79.52	79.52	83.05	86.59	90.12	93.65	97.19	
Total = Sum(44) _{1...12} =													1060.23 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.13	126.05	130.08	113.4	108.81	93.9	87.01	99.85	101.04	117.75	128.53	139.58	
Total = Sum(45) _{1...12} =													1390.13 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.62	18.91	19.51	17.01	16.32	14.08	13.05	14.98	15.16	17.66	19.28	20.94	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.4	175.98	185.35	166.9	164.09	147.39	142.29	155.12	154.53	173.03	182.03	194.86	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.4	175.98	185.35	166.9	164.09	147.39	142.29	155.12	154.53	173.03	182.03	194.86	
Output from water heater (annual) _{1...12}												2040.97	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	92.14	81.85	87.47	80.5	80.4	74.02	73.15	77.42	76.39	83.37	85.53	90.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114	114	114	114	114	114	114	114	114	114	114	114	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.61	16.53	13.44	10.18	7.61	6.42	6.94	9.02	12.11	15.37	17.94	19.13	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.59	202.67	197.42	186.26	172.16	158.91	150.06	147.98	153.23	164.39	178.49	191.74	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	(71)

Water heating gains (Table 5)

(72)m=	123.85	121.81	117.57	111.81	108.07	102.8	98.32	104.06	106.1	112.06	118.79	121.82	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	400.25	398.21	385.64	365.45	345.04	325.34	312.53	318.26	328.64	349.03	372.43	389.89	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (76)
East	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04 (76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39 (76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39 (76)

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East	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 55.1 107.78 177.5 258.87 317.25 324.77 309.19 265.59 206.44 127.89 68.7 45.31 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 455.35 505.99 563.14 624.32 662.29 650.11 621.72 583.86 535.07 476.92 441.13 435.19 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	1	0.99	0.99	0.95	0.85	0.68	0.5	0.56	0.82	0.97	0.99	1

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m= 19.99 20.11 20.34 20.62 20.86 20.97 21 20.99 20.92 20.61 20.24 19.95 (87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.81	0.59	0.4	0.45	0.74	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.72	18.9	19.23	19.63	19.94	20.06	20.07	20.07	20.01	19.62	19.09	18.67	(90)

fLA = Living area ÷ (4) =	0.4	(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.23	19.39	19.67	20.03	20.31	20.42	20.44	20.44	20.37	20.02	19.55	19.18	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.23	19.39	19.67	20.03	20.31	20.42	20.44	20.44	20.37	20.02	19.55	19.18	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.93	0.82	0.62	0.44	0.49	0.77	0.95	0.99	1	(94)

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	453.19	501.4	550.37	582.18	542.62	406.18	275.43	288.34	411.5	455.1	436.85	433.57	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm, W = [(39)m × ((93)m – (96)m)]

(97)m=	1076.83	1045.01	950.22	802.8	620.71	419.9	277.13	291.38	452.48	679.45	898.02	1080.69	(97)

Space heating requirement for each month, kWh/month = 0.024 × [(97)m – (95)m] × (41)m

(98)m=	463.99	365.3	297.48	158.84	58.09	0	0	0	0	166.91	332.04	481.45	(98)

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	2324.12	(98)

Space heating requirement in kWh/m²/year

32.54	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)

Fraction of space heat from community system 1 – (301) =

1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1	(303a)

Fraction of total space heat from Community boilers

(302) × (303a) =	1	(304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)

Distribution loss factor (Table 12c) for community heating system

1.05	(306)

Space heating

Annual space heating requirement

kWh/year	2324.12

Space heat from Community boilers

(98) × (304a) × (305) × (306) =	2440.33	(307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0	(308)

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Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)
Water heating			
Annual water heating requirement		2040.97	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	2143.01	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	45.83	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.22	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	46.22	(331)
Energy for lighting (calculated in Appendix L)		328.7	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1064.52 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 23.79 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1088.31 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1088.31 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 23.99 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 170.6 (379)
Total CO2, kg/year	sum of (376)...(382) =		1282.89 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		17.96 (384)
El rating (section 14)			85.23 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-2-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	53.01 (1a) x	2.4 (2a) =	127.22 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.01 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	127.22 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0	(9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0	(12)

If no draught lobby, enter 0.05, else enter 0	0	(13)

Percentage of windows and doors draught stripped	0	(14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4	(17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			4.6	$\times 1/[1/(1.2)+0.04]$	5.27		
Windows Type 2			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 3			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 4			1.84	$\times 1/[1/(1.2)+0.04]$	2.11		
Floor			53.01	0.11	5.8311		
Walls Type1	37.55	11.96	25.59	0.18	4.61		
Walls Type2	25.99	2.1	23.89	0.18	4.3		
Total area of elements, m²			116.55				
Party wall			14.75	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 30.95 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.77 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.73 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=

20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

62.72	62.72	62.72	62.72	62.72	62.72	62.72	62.72	62.72	62.72	62.72	62.72

Average = Sum(39)_{1...12} /12=

62.72

 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18

Average = Sum(40)_{1...12} /12=

1.18

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

1.78

 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

76.45

 (43)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
84.09	81.03	77.98	74.92	71.86	68.8	68.8	71.86	74.92	77.98	81.03	84.09

Total = Sum(44)_{1...12} =

917.37

 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

124.71	109.07	112.55	98.12	94.15	81.25	75.29	86.39	87.42	101.88	111.21	120.77

Total = Sum(45)_{1...12} =

1202.82

 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

18.71	16.36	16.88	14.72	14.12	12.19	11.29	12.96	13.11	15.28	16.68	18.12

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

 (48)

Temperature factor from Table 2b

0

 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110

 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

 (52)

Temperature factor from Table 2b

0.6

 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03

 (54)

Enter (50) or (54) in (55)

1.03

 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

DER WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.98	159	167.83	151.62	149.43	134.74	130.56	141.67	140.92	157.16	164.71	176.05

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=	179.98	159	167.83	151.62	149.43	134.74	130.56	141.67	140.92	157.16	164.71	176.05

Output from water heater (annual)_{1...12}

1853.66

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.69	76.21	81.64	75.42	75.53	69.81	69.25	72.95	71.86	78.1	79.77	84.38

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.82	12.28	9.98	7.56	5.65	4.77	5.15	6.7	8.99	11.42	13.33	14.21

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	155.04	156.65	152.6	143.97	133.07	122.83	115.99	114.38	118.44	127.07	137.96	148.2

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89

(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15

(71)

Water heating gains (Table 5)

(72)m=	115.17	113.4	109.74	104.75	101.51	96.96	93.08	98.05	99.81	104.97	110.8	113.41

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	333.72	332.02	322	305.96	289.92	274.24	263.91	268.81	276.92	293.14	311.77	325.5

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (76)

(76)

(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	113.51	195.48	270.93	337.99	378.11	374.49	361.47	332.12	294.49	217.19	136.4	96.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	447.23	527.49	592.93	643.95	668.03	648.73	625.38	600.93	571.41	510.33	448.17	422.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	0.99	0.98	0.95	0.89	0.77	0.6	0.44	0.47	0.7	0.91	0.98	0.99	

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.94	20.13	20.39	20.67	20.88	20.97	21	20.99	20.94	20.67	20.24	19.88	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.94	0.86	0.71	0.51	0.33	0.37	0.61	0.88	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.54	18.83	19.2	19.58	19.82	19.92	19.93	19.93	19.89	19.59	18.98	18.47	(90)

fLA = Living area ÷ (4) =

0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.24	19.48	19.8	20.13	20.35	20.45	20.46	20.46	20.42	20.13	19.61	19.18	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.24	19.48	19.8	20.13	20.35	20.45	20.46	20.46	20.42	20.13	19.61	19.18	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.94	0.87	0.73	0.55	0.39	0.42	0.65	0.89	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	440.98	511.93	555.93	557.45	490.78	356.6	240.9	252.57	373.5	453.8	435.44	417.71	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	937.04	914.39	833.91	704.02	542.61	366.59	242.32	254.75	396.2	597.67	784.7	939.25	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	369.07	270.45	206.81	105.53	38.56	0	0	0	0	107.04	251.46	388.02	(98)

Total per year (kWh/year) = Sum(98)1...5,9...12 = 1736.96 (99)

Space heating requirement in kWh/m²/year

32.77 (99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

kWh/year

Annual space heating requirement

1736.96

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

1823.81 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

1853.66

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

1946.34 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

37.7 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

34.3 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

34.3 (331)

Energy for lighting (calculated in Appendix L)

244.11 (332)

12b. CO2 Emissions – Community heating scheme

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%)

If there is CHP using two fuels repeat (363) to (366) for the second fuel

93 (367a)

CO2 associated with heat source 1

[(307b)+(310b)] x 100 ÷ (367b) x

0.22

= 875.65 (367)

Electrical energy for heat distribution

[(313) x

0.52

= 19.57 (372)

Total CO2 associated with community systems

(363)...(366) + (368)...(372)

= 895.22 (373)

CO2 associated with space heating (secondary)

(309) x

0

= 0 (374)

CO2 associated with water from immersion heater or instantaneous heater

(312) x

0.22

= 0 (375)

Total CO2 associated with space and water heating

(373) + (374) + (375) =

895.22 (376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	=	17.8	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	126.69	(379)
Total CO2, kg/year	sum of (376)...(382) =			1039.71	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			19.61	(384)
El rating (section 14)				85.79	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-2-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	79.03 (1a) x	2.4 (2a) =	189.67 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.03 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	189.67 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		(26)
Windows Type 1			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 3			5.29	$\times 1/[1/(1.2) + 0.04]$	6.06		(27)
Windows Type 4			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 5			5.29	$\times 1/[1/(1.2) + 0.04]$	6.06		(27)
Floor			79.03	0.11	8.6933		(28)
Walls Type1	42.8	18.86	23.94	0.18	4.31		(29)
Walls Type2	13.9	2.1	11.8	0.18	2.12		(29)
Total area of elements, m²			135.73				(31)
Party wall			39.79	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 39.24 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.29 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 51.53 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

82.83	82.83	82.83	82.83	82.83	82.83	82.83	82.83	82.83	82.83	82.83	82.83

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

82.83

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

1.05

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.44

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

92.25

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

101.47	97.78	94.09	90.4	86.71	83.02	83.02	86.71	90.4	94.09	97.78	101.47

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1107

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

150.48	131.61	135.81	118.41	113.61	98.04	90.85	104.25	105.49	122.94	134.2	145.74

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1451.45

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

22.57	19.74	20.37	17.76	17.04	14.71	13.63	15.64	15.82	18.44	20.13	21.86

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(56)

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

205.76	181.54	191.09	171.9	168.89	151.53	146.13	159.53	158.99	178.22	187.7	201.01

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

205.76	181.54	191.09	171.9	168.89	151.53	146.13	159.53	158.99	178.22	187.7	201.01

Output from water heater (annual) ^{1...12}	2102.29

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

94.26	83.7	89.38	82.16	82	75.39	74.43	78.88	77.87	85.1	87.42	92.68

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

19.38	17.21	14	10.6	7.92	6.69	7.23	9.39	12.61	16.01	18.69	19.92

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

217.4	219.66	213.97	201.87	186.59	172.23	162.64	160.39	166.07	178.17	193.45	207.81

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77

 (71)

Water heating gains (Table 5)

(72)m=

126.69	124.56	120.13	114.12	110.21	104.71	100.04	106.03	108.16	114.38	121.41	124.57

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

423.14	421.09	407.77	386.25	364.39	343.3	329.57	335.47	346.5	368.23	393.21	411.96

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	5.29	x	46.75	x	0.5	x	0.8	=	68.56	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	5.29	x	76.57	x	0.5	x	0.8	=	112.28	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	5.29	x	97.53	x	0.5	x	0.8	=	143.02	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	5.29	x	110.23	x	0.5	x	0.8	=	161.65	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	5.29	x	114.87	x	0.5	x	0.8	=	168.45	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	5.29	x	110.55	x	0.5	x	0.8	=	162.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	5.29	x	108.01	x	0.5	x	0.8	=	158.39	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	5.29	x	104.89	x	0.5	x	0.8	=	153.82	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	5.29	x	101.89	x	0.5	x	0.8	=	149.4	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	5.29	x	82.59	x	0.5	x	0.8	=	121.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	5.29	x	55.42	x	0.5	x	0.8	=	81.26	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	5.29	x	40.4	x	0.5	x	0.8	=	59.24	(78)
West	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	183.92	315.17	433.45	536.24	596.58	589.6	569.61	525.59	469.52	349.2	220.71	157.09	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	607.06	736.27	841.22	922.49	960.97	932.9	899.18	861.06	816.01	717.43	613.92	569.06	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.88	0.74	0.56	0.4	0.44	0.67	0.91	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.26	20.52	20.77	20.93	20.99	21	21	20.97	20.75	20.34	20	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.84	0.68	0.48	0.32	0.35	0.59	0.88	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.8	19.09	19.45	19.79	19.98	20.04	20.04	20.04	20.02	19.77	19.21	18.72	(90)

fLA = Living area ÷ (4) =

0.4	(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.3	19.56	19.88	20.18	20.36	20.42	20.42	20.4	20.16	19.66	19.23	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

DER WorkSheet: New dwelling design stage

(93)m=	19.3	19.56	19.88	20.18	20.36	20.42	20.42	20.42	20.4	20.16	19.66	19.23	(93)

8. Space heating requirement

Set $T_{i,m}$ to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, h_m :

(94)m=	0.99	0.97	0.93	0.85	0.7	0.51	0.35	0.39	0.62	0.88	0.98	0.99	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	600.58	716.18	786.31	783.61	673.07	475.12	316.07	332.1	504.02	633.32	598.96	564.58	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	1242.47	1214.25	1108.01	934.21	717.04	481.7	316.8	333.3	521.69	792.08	1040.25	1245.02	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	477.57	334.71	239.35	108.43	32.71	0	0	0	0	118.12	317.73	506.25	

Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$ 2134.87 (98)

Space heating requirement in $kWh/m^2/year$

27.01 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2134.87

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

2241.61 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2102.29

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2207.4 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$

44.49 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

51.14 (330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	51.14	(331)
Energy for lighting (calculated in Appendix L)		342.28	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1033.32 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 23.09 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1056.41 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1056.41 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 26.54 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 177.64 (379)
Total CO2, kg/year	sum of (376)...(382) =		1260.6 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		15.95 (384)
EI rating (section 14)			86.38 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-2-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	105.24 (1a) x	2.4 (2a) =	252.58 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	105.24 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	252.58 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)					0 (9)
Additional infiltration					[(9)-1]x0.1 = 0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction					0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0					0 (12)
If no draught lobby, enter 0.05, else enter 0					0 (13)
Percentage of windows and doors draught stripped					0 (14)
Window infiltration				0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate				(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area					4 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)					0.2 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor				(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		(26)
Windows Type 1			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 2			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		(27)
Windows Type 3			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		(27)
Windows Type 4			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		(27)
Windows Type 5			4.6	$\times 1/[1/(1.2) + 0.04]$	5.27		(27)
Floor			105.24	0.11	11.5764		(28)
Walls Type1	30.46	12.88	17.58	0.18	3.16		(29)
Walls Type2	29.12	2.1	27.02	0.18	4.86		(29)
Total area of elements, m²			164.82				(31)
Party wall			42.26	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 36.87 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.19 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 49.06 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	90.73	90.73	90.73	90.73	90.73	90.73	90.73	90.73	90.73	90.73	90.73	90.73	
Average = Sum(39) _{1...12} /12=												90.73	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	
Average = Sum(40) _{1...12} /12=												0.86	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 100.3 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$	110.33	106.31	102.3	98.29	94.28	90.27	90.27	94.28	98.29	102.3	106.31	110.33	
(44)m=	110.33	106.31	102.3	98.29	94.28	90.27	90.27	94.28	98.29	102.3	106.31	110.33	
Total = Sum(44) _{1...12} =												1203.56	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	163.61	143.1	147.66	128.73	123.52	106.59	98.77	113.34	114.7	133.67	145.91	158.45	
Total = Sum(45) _{1...12} =												1578.06	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	24.54	21.46	22.15	19.31	18.53	15.99	14.82	17	17.2	20.05	21.89	23.77	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year $(48) \times (49) =$ 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) =$ 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month $((56)m = (55) \times (41)m$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

218.89	193.02	202.94	182.23	178.8	160.09	154.05	168.62	168.19	188.95	199.4	213.73

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

218.89	193.02	202.94	182.23	178.8	160.09	154.05	168.62	168.19	188.95	199.4	213.73

Output from water heater (annual) ^{1...12}	2228.9

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

98.62	87.52	93.32	85.6	85.29	78.24	77.06	81.91	80.93	88.67	91.31	96.91

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

25.31	22.48	18.28	13.84	10.34	8.73	9.44	12.27	16.46	20.9	24.4	26.01

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

264.53	267.28	260.36	245.63	227.04	209.57	197.9	195.16	202.07	216.8	235.39	252.86

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32

 (71)

Water heating gains (Table 5)

(72)m=

132.56	130.24	125.43	118.89	114.64	108.66	103.58	110.09	112.41	119.18	126.82	130.25

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

487.14	484.74	468.81	443.1	416.77	391.71	375.66	382.26	395.69	421.62	451.35	473.86

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)

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West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	70.12	137.17	225.91	329.47	403.78	413.34	393.52	338.02	262.74	162.77	87.43	57.67	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	557.26	621.91	694.72	772.58	820.55	805.05	769.18	720.28	658.43	584.39	538.79	531.53	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.88	0.69	0.52	0.57	0.84	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.1	20.21	20.41	20.67	20.88	20.98	21	20.99	20.93	20.65	20.32	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.95	0.84	0.62	0.42	0.48	0.78	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.98	19.14	19.43	19.8	20.08	20.19	20.2	20.2	20.14	19.78	19.3	18.93	(90)

fLA = Living area ÷ (4) =

0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.31	19.46	19.73	20.06	20.32	20.42	20.44	20.44	20.38	20.04	19.61	19.27	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.31	19.46	19.73	20.06	20.32	20.42	20.44	20.44	20.38	20.04	19.61	19.27	(93)

8. Space heating requirement

Set $T_{i,m}$ to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, h_m :

(94)m=	1	1	0.99	0.95	0.84	0.64	0.45	0.51	0.79	0.97	1	1	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	556.15	619.19	685.56	734.77	691.6	515.39	347.03	363.82	523.24	567.13	536.31	530.74	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	1362.22	1321.13	1200.05	1012.76	782.34	528.4	348.26	366.26	569.85	856.81	1134.73	1367.38	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	599.72	471.7	382.78	200.16	67.51	0	0	0	0	215.52	430.86	622.46	

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 2990.7 (98)

Space heating requirement in $kWh/m^2/year$

28.42 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2990.7

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 3140.24 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2228.9

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2340.35 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 54.81 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

68.1 (330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	68.1	(331)
Energy for lighting (calculated in Appendix L)		446.9	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1272.91 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 28.44 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1301.35 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1301.35 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 35.34 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 231.94 (379)
Total CO2, kg/year	sum of (376)...(382) =		1568.64 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		14.91 (384)
EI rating (section 14)			86.01 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-2-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	86.91 (1a) x	2.4 (2a) =	208.58 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.91 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	208.58 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		(26)
Windows Type 1			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 3			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		(27)
Windows Type 4			5.29	$\times 1/[1/(1.2) + 0.04]$	6.06		(27)
Windows Type 5			4.6	$\times 1/[1/(1.2) + 0.04]$	5.27		(27)
Floor			86.91	0.11	9.560101		(28)
Walls Type1	47.44	17.25	30.19	0.18	5.43		(29)
Walls Type2	10.78	2.1	8.68	0.18	1.56		(29)
Total area of elements, m²			145.13				(31)
Party wall			48.43	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 38.83 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 13.01 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 51.84 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

86.25	86.25	86.25	86.25	86.25	86.25	86.25	86.25	86.25	86.25	86.25	86.25

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

86.25

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

0.99

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.58

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

95.5

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

105.05	101.23	97.41	93.59	89.77	85.95	85.95	89.77	93.59	97.41	101.23	105.05

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1145.99

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

155.78	136.25	140.6	122.58	117.62	101.49	94.05	107.92	109.21	127.27	138.93	150.87

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1502.57

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

23.37	20.44	21.09	18.39	17.64	15.22	14.11	16.19	16.38	19.09	20.84	22.63

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

211.06	186.18	195.88	176.07	172.89	154.99	149.33	163.2	162.7	182.55	192.42	206.15

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

211.06	186.18	195.88	176.07	172.89	154.99	149.33	163.2	162.7	182.55	192.42	206.15

Output from water heater (annual) ^{1...12}	2153.41

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

96.02	85.25	90.97	83.55	83.33	76.54	75.49	80.11	79.11	86.54	88.99	94.39

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

20.79	18.47	15.02	11.37	8.5	7.18	7.75	10.08	13.53	17.18	20.05	21.37

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

233.28	235.7	229.6	216.61	200.22	184.81	174.52	172.1	178.2	191.18	207.58	222.98

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24

 (71)

Water heating gains (Table 5)

(72)m=

129.06	126.85	122.27	116.04	112	106.31	101.47	107.67	109.87	116.32	123.6	126.86

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

444.84	442.73	428.6	405.74	382.43	360.01	345.46	351.56	363.31	386.39	412.94	432.93

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)

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West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	80.71	157.17	260.4	387.27	484.5	501.1	474.91	400.76	304.85	186.61	100.42	66.55	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	525.55	599.91	689.01	793.01	866.93	861.11	820.37	752.32	668.16	573.01	513.36	499.48	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.94	0.82	0.62	0.46	0.52	0.8	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.98	20.12	20.36	20.67	20.89	20.98	21	20.99	20.93	20.62	20.23	19.94	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.76	0.54	0.37	0.42	0.72	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.72	18.93	19.28	19.71	19.99	20.08	20.09	20.09	20.04	19.65	19.1	18.67	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.23	19.4	19.71	20.09	20.35	20.44	20.45	20.45	20.39	20.04	19.55	19.18	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.23	19.4	19.71	20.09	20.35	20.44	20.45	20.45	20.39	20.04	19.55	19.18	(93)

8. Space heating requirement

Set $T_{i,m}$ to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, h_m :

(94)m=	1	0.99	0.98	0.92	0.78	0.57	0.4	0.46	0.75	0.96	0.99	1	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	523.6	595.01	672.69	729.35	675.88	493.33	331.06	346.89	500.94	547.31	509.24	498.07	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	1287.5	1250.94	1139.62	965.2	746.19	503.64	332.24	349.33	542.81	813.99	1073.92	1291.91	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	568.34	440.78	347.4	169.81	52.31	0	0	0	0	198.41	406.57	590.62	

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 2774.25 (98)

Space heating requirement in $kWh/m^2/year$

31.92 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2774.25

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 2912.96 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2153.41

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2261.09 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 51.74 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

56.24 (330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	56.24	(331)
Energy for lighting (calculated in Appendix L)		367.2	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1201.71 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 26.85 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1228.57 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1228.57 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 29.19 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 190.58 (379)
Total CO2, kg/year	sum of (376)...(382) =		1448.33 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		16.66 (384)
EI rating (section 14)			85.29 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-3-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	86.14 (1a) x	2.4 (2a) =	206.74 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.14 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	206.74 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		(26)
Windows Type 1			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		(27)
Windows Type 2			1.84	$\times 1/[1/(1.2)+0.04]$	2.11		(27)
Windows Type 3			1.84	$\times 1/[1/(1.2)+0.04]$	2.11		(27)
Windows Type 4			5.29	$\times 1/[1/(1.2)+0.04]$	6.06		(27)
Windows Type 5			8.05	$\times 1/[1/(1.2)+0.04]$	9.22		(27)
Walls Type1	44.62	19.78	24.84	0.18	4.47		(29)
Walls Type2	5.87	2.1	3.77	0.18	0.68		(29)
Total area of elements, m²			50.49				(31)
Party wall			44.11	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 30.32 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.68 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=

34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79

Average = Sum(39)_{1...12} / 12 =

71.79 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83

Average = Sum(40)_{1...12} / 12 =

0.83 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

2.57 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

95.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
104.74	100.93	97.12	93.31	89.5	85.69	85.69	89.5	93.31	97.12	100.93	104.74

Total = Sum(44)_{1...12} =

1142.6 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

155.32	135.85	140.18	122.21	117.27	101.19	93.77	107.6	108.89	126.9	138.52	150.42

Total = Sum(45)_{1...12} =

1498.13 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

23.3	20.38	21.03	18.33	17.59	15.18	14.07	16.14	16.33	19.03	20.78	22.56

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03 (52)

Temperature factor from Table 2b

0.6 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03 (54)

Enter (50) or (54) in (55)

1.03 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.6	185.77	195.46	175.71	172.54	154.69	149.05	162.88	162.38	182.17	192.01	205.7

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=	210.6	185.77	195.46	175.71	172.54	154.69	149.05	162.88	162.38	182.17	192.01	205.7

Output from water heater (annual)_{1...12}

2148.97

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	95.87	85.11	90.83	83.43	83.21	76.44	75.4	80	79	86.42	88.85	94.24

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46	128.46

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.66	18.35	14.93	11.3	8.45	7.13	7.71	10.02	13.44	17.07	19.92	21.24

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	231.79	234.2	228.14	215.23	198.95	183.64	173.41	171	177.07	189.97	206.26	221.57

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85

(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76	-102.76

(71)

Water heating gains (Table 5)

(72)m=	128.85	126.65	122.09	115.88	111.85	106.17	101.34	107.53	109.72	116.15	123.41	126.66

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	442.85	440.74	426.69	403.95	380.78	358.47	344	350.08	361.77	384.73	411.12	431.01

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42

(74)

(74)

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North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)

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North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
East	0.9x	0.77	x	8.05	x	19.64	x	0.5	x	0.8	=	43.83	(76)
East	0.9x	0.77	x	8.05	x	38.42	x	0.5	x	0.8	=	85.73	(76)
East	0.9x	0.77	x	8.05	x	63.27	x	0.5	x	0.8	=	141.19	(76)
East	0.9x	0.77	x	8.05	x	92.28	x	0.5	x	0.8	=	205.92	(76)
East	0.9x	0.77	x	8.05	x	113.09	x	0.5	x	0.8	=	252.36	(76)
East	0.9x	0.77	x	8.05	x	115.77	x	0.5	x	0.8	=	258.34	(76)
East	0.9x	0.77	x	8.05	x	110.22	x	0.5	x	0.8	=	245.95	(76)
East	0.9x	0.77	x	8.05	x	94.68	x	0.5	x	0.8	=	211.27	(76)
East	0.9x	0.77	x	8.05	x	73.59	x	0.5	x	0.8	=	164.21	(76)
East	0.9x	0.77	x	8.05	x	45.59	x	0.5	x	0.8	=	101.73	(76)
East	0.9x	0.77	x	8.05	x	24.49	x	0.5	x	0.8	=	54.65	(76)
East	0.9x	0.77	x	8.05	x	16.15	x	0.5	x	0.8	=	36.04	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	78.4	151.81	253.47	386.27	495.3	518.41	488.76	403.91	299.2	180.38	97.3	64.86	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.25	592.55	680.16	790.21	876.08	876.89	832.76	753.99	660.97	565.11	508.42	495.87	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	1	0.99	0.98	0.9	0.73	0.52	0.38	0.44	0.72	0.96	0.99	1	

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.34	20.57	20.82	20.96	21	21	21	20.98	20.76	20.43	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.46	0.31	0.36	0.65	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.17	19.36	19.67	20.02	20.19	20.22	20.22	20.22	20.21	19.95	19.48	19.11	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.59	19.75	20.03	20.34	20.5	20.53	20.53	20.53	20.51	20.28	19.86	19.54	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.59	19.75	20.03	20.34	20.5	20.53	20.53	20.53	20.51	20.28	19.86	19.54	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.88	0.7	0.48	0.34	0.39	0.68	0.94	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	519.16	586.89	659.01	698.48	609.29	423.94	282.32	296.41	446.51	530.61	503.6	494.41	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1097.48	1066.25	971.41	821.6	631.89	425.88	282.47	296.81	460.5	694.63	916.21	1101.25	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	430.27	322.13	232.43	88.65	16.82	0	0	0	0	122.03	297.08	451.49	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1960.9 (98)

Space heating requirement in kWh/m²/year

22.76 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
1960.9

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 2058.94 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2148.97

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2256.41 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] = 43.15 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

55.74 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) = 55.74 (331)

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Energy for lighting (calculated in Appendix L)

364.94 (332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1002.28 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 22.4 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1024.67 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1024.67 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 28.93 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 189.41 (379)
Total CO2, kg/year	sum of (376)...(382) =		1243.01 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		14.43 (384)
El rating (section 14)			87.3 (385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-3-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	71.42 (1a) x	2.4 (2a) =	171.41 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.42 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.41 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 3			4.6	$\times 1/[1/(1.2) + 0.04]$	5.27		
Walls Type1	28.74	10.12	18.62	0.18	3.35		
Walls Type2	43.06	2.1	40.96	0.18	7.37		
Total area of elements, m²			71.8				
Party wall			14.79	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 24.83 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.86 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 32.69 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	60.97	60.97	60.97	60.97	60.97	60.97	60.97	60.97	60.97	60.97	60.97	60.97
Average = Sum(39) _{1...12} /12=												60.97 (39)

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Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85		
Average = Sum(40) _{1...12} /12=													0.85	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.28

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

88.35

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.19	93.65	90.12	86.59	83.05	79.52	79.52	83.05	86.59	90.12	93.65	97.19		
Total = Sum(44) _{1...12} =													1060.23	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.13	126.05	130.08	113.4	108.81	93.9	87.01	99.85	101.04	117.75	128.53	139.58		
Total = Sum(45) _{1...12} =													1390.13	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.62	18.91	19.51	17.01	16.32	14.08	13.05	14.98	15.16	17.66	19.28	20.94		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.4	175.98	185.35	166.9	164.09	147.39	142.29	155.12	154.53	173.03	182.03	194.86	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.4	175.98	185.35	166.9	164.09	147.39	142.29	155.12	154.53	173.03	182.03	194.86	
Output from water heater (annual) _{1...12}												2040.97	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	92.14	81.85	87.47	80.5	80.4	74.02	73.15	77.42	76.39	83.37	85.53	90.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114	114	114	114	114	114	114	114	114	114	114	114	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.61	16.53	13.44	10.18	7.61	6.42	6.94	9.02	12.11	15.37	17.94	19.13	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.59	202.67	197.42	186.26	172.16	158.91	150.06	147.98	153.23	164.39	178.49	191.74	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	(71)

Water heating gains (Table 5)

(72)m=	123.85	121.81	117.57	111.81	108.07	102.8	98.32	104.06	106.1	112.06	118.79	121.82	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	400.25	398.21	385.64	365.45	345.04	325.34	312.53	318.26	328.64	349.03	372.43	389.89	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d			Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (76)
East	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04 (76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39 (76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39 (76)

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East	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=

55.1	107.78	177.5	258.87	317.25	324.77	309.19	265.59	206.44	127.89	68.7	45.31

 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=

455.35	505.99	563.14	624.32	662.29	650.11	621.72	583.86	535.07	476.92	441.13	435.19

 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.99	0.98	0.93	0.79	0.59	0.43	0.48	0.74	0.95	0.99	1

 (86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=

20.22	20.33	20.54	20.78	20.94	20.99	21	21	20.97	20.75	20.43	20.18

 (87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.74	0.52	0.35	0.4	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.16	19.33	19.62	19.95	20.15	20.2	20.21	20.21	20.18	19.92	19.47	19.1	(90)

fLA = Living area ÷ (4) =	0.4	(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.58	19.73	19.99	20.28	20.47	20.52	20.52	20.52	20.5	20.25	19.85	19.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.58	19.73	19.99	20.28	20.47	20.52	20.52	20.52	20.5	20.25	19.85	19.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.97	0.91	0.76	0.55	0.38	0.43	0.7	0.94	0.99	1	(94)

Useful gains, hmGm, W = (94)m x (84)m

(95)m=	452.99	500.57	546.55	565.94	501.8	357.12	238.92	250.76	374.7	447.3	436.05	433.48	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm, W = [(39)m x [(93)m – (96)m]

(97)m=	931.67	904.26	822.39	694.06	534.48	360.83	239.24	251.4	390.05	588.7	777.65	934.97	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	356.13	271.29	205.23	92.25	24.31	0	0	0	0	105.21	245.95	373.11	(98)

Total per year (kWh/year) = Sum(98)1...5,9...12 =	1673.48	(98)

Space heating requirement in kWh/m²/year

23.43	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)

Fraction of space heat from community system 1 – (301) =

1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1	(303a)

Fraction of total space heat from Community boilers

(302) x (303a) =	1	(304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)

Distribution loss factor (Table 12c) for community heating system

1.05	(306)

Space heating

Annual space heating requirement

kWh/year

1673.48	(307a)

Space heat from Community boilers

(98) x (304a) x (305) x (306) =	1757.16	(307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0	(308)

DER WorkSheet: New dwelling design stage

Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)
Water heating			
Annual water heating requirement		2040.97	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	2143.01	(310a)
Electricity used for heat distribution	$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$	39	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.22	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	46.22	(331)
Energy for lighting (calculated in Appendix L)		328.7	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		
			93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 905.85 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 20.24 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 926.09 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		926.09 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 23.99 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 170.6 (379)
Total CO2, kg/year	sum of (376)...(382) =		1120.67 (383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =		15.69 (384)
EI rating (section 14)			87.1 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-3-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	53.01 (1a) x	2.4 (2a) =	127.22 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.01 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	127.22 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			4.6	$\times 1/[1/(1.2) + 0.04]$	5.27		
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 3			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 4			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		
Walls Type1	37.55	11.96	25.59	0.18	4.61		
Walls Type2	25.99	2.1	23.89	0.18	4.3		
Total area of elements, m²			63.54				
Party wall			14.75	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 25.12 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.73 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 32.85 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99	20.99

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 53.84 53.84 53.84 53.84 53.84 53.84 53.84 53.84 53.84 53.84 53.84 53.84 (39)

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Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02		
Average = Sum(40) _{1...12} /12=													1.02	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

1.78

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

76.45

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	84.09	81.03	77.98	74.92	71.86	68.8	68.8	71.86	74.92	77.98	81.03	84.09		
Total = Sum(44) _{1...12} =													917.37	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	124.71	109.07	112.55	98.12	94.15	81.25	75.29	86.39	87.42	101.88	111.21	120.77		
Total = Sum(45) _{1...12} =													1202.82	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.71	16.36	16.88	14.72	14.12	12.19	11.29	12.96	13.11	15.28	16.68	18.12		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.98	159	167.83	151.62	149.43	134.74	130.56	141.67	140.92	157.16	164.71	176.05	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.98	159	167.83	151.62	149.43	134.74	130.56	141.67	140.92	157.16	164.71	176.05	
Output from water heater (annual) _{1...12}												1853.66	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	85.69	76.21	81.64	75.42	75.53	69.81	69.25	72.95	71.86	78.1	79.77	84.38	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	88.94	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.82	12.28	9.98	7.56	5.65	4.77	5.15	6.7	8.99	11.42	13.33	14.21	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	155.04	156.65	152.6	143.97	133.07	122.83	115.99	114.38	118.44	127.07	137.96	148.2	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	-71.15	(71)

Water heating gains (Table 5)

(72)m=	115.17	113.4	109.74	104.75	101.51	96.96	93.08	98.05	99.81	104.97	110.8	113.41	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	333.72	332.02	322	305.96	289.92	274.24	263.91	268.81	276.92	293.14	311.77	325.5	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39 (76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39 (76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41 (76)

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East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)

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South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	113.51	195.48	270.93	337.99	378.11	374.49	361.47	332.12	294.49	217.19	136.4	96.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	447.23	527.49	592.93	643.95	668.03	648.73	625.38	600.93	571.41	510.33	448.17	422.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.94	0.85	0.71	0.52	0.38	0.41	0.63	0.88	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.17	20.36	20.59	20.81	20.95	20.99	21	21	20.98	20.8	20.44	20.12	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.82	0.65	0.45	0.3	0.33	0.55	0.85	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.98	19.25	19.58	19.87	20.02	20.06	20.07	20.07	20.05	19.86	19.37	18.91	(90)

fLA = Living area ÷ (4) =

0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.58	19.81	20.09	20.34	20.48	20.53	20.53	20.53	20.52	20.33	19.9	19.51	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.58	19.81	20.09	20.34	20.48	20.53	20.53	20.53	20.52	20.33	19.9	19.51	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.98	0.96	0.92	0.83	0.67	0.49	0.34	0.37	0.59	0.86	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	440.2	508.76	546.18	533.29	450.38	316.02	211.5	222.03	336.81	438.14	432.93	417.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	822.64	802.65	731.51	616.09	473	319.2	211.85	222.59	345.46	524.08	689.26	824.57	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	284.53	197.49	137.88	59.61	16.83	0	0	0	0	63.94	184.55	303.03	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1247.87 (98)

Space heating requirement in kWh/m²/year

23.54 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

DER WorkSheet: New dwelling design stage

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)
<i>The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.</i>			
Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		kWh/year	
Annual space heating requirement		1247.87	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1310.27	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1853.66	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1946.34	(310a)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	32.57	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		34.3	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	34.3	(331)
Energy for lighting (calculated in Appendix L)		244.11	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	= 756.37 (367)
Electrical energy for heat distribution	[(313) x	0.52	= 16.9 (372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)		= 773.28 (373)
CO2 associated with space heating (secondary)	(309) x	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	= 0 (375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		773.28 (376)
CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	= 17.8 (378)

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CO2 associated with electricity for lighting	(332))) x	0.52	=	126.69	(379)
Total CO2, kg/year	sum of (376)...(382) =			917.77	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			17.31	(384)
El rating (section 14)				87.45	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-3-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	79.03 (1a) x	2.4 (2a) =	189.67 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.03 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	189.67 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		(26)
Windows Type 1			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		(27)
Windows Type 2			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		(27)
Windows Type 3			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		(27)
Windows Type 4			5.29	$\times 1/[1/(1.2)+0.04]$	6.06		(27)
Windows Type 5			5.29	$\times 1/[1/(1.2)+0.04]$	6.06		(27)
Walls Type1	42.8	18.86	23.94	0.18	4.31		(29)
Walls Type2	13.9	2.1	11.8	0.18	2.12		(29)
Total area of elements, m²			56.7				(31)
Party wall			39.79	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 30.55 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.51 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=

31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

69.8	69.8	69.8	69.8	69.8	69.8	69.8	69.8	69.8	69.8	69.8	69.8

Average = Sum(39)_{1...12} /12=

69.8 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88

Average = Sum(40)_{1...12} /12=

0.88 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

2.44 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

92.25 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

101.47	97.78	94.09	90.4	86.71	83.02	83.02	86.71	90.4	94.09	97.78	101.47

Total = Sum(44)_{1...12} =

1107 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

150.48	131.61	135.81	118.41	113.61	98.04	90.85	104.25	105.49	122.94	134.2	145.74

Total = Sum(45)_{1...12} =

1451.45 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

22.57	19.74	20.37	17.76	17.04	14.71	13.63	15.64	15.82	18.44	20.13	21.86

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03 (52)

Temperature factor from Table 2b

0.6 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03 (54)

Enter (50) or (54) in (55)

1.03 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

205.76	181.54	191.09	171.9	168.89	151.53	146.13	159.53	158.99	178.22	187.7	201.01

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=

205.76	181.54	191.09	171.9	168.89	151.53	146.13	159.53	158.99	178.22	187.7	201.01

Output from water heater (annual)_{1...12}

2102.29

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=

94.26	83.7	89.38	82.16	82	75.39	74.43	78.88	77.87	85.1	87.42	92.68

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21	122.21

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

19.38	17.21	14	10.6	7.92	6.69	7.23	9.39	12.61	16.01	18.69	19.92

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

217.4	219.66	213.97	201.87	186.59	172.23	162.64	160.39	166.07	178.17	193.45	207.81

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22

(69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77	-97.77

(71)

Water heating gains (Table 5)

(72)m=

126.69	124.56	120.13	114.12	110.21	104.71	100.04	106.03	108.16	114.38	121.41	124.57

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

423.14	421.09	407.77	386.25	364.39	343.3	329.57	335.47	346.5	368.23	393.21	411.96

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)

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South	0.9x	0.77	x	5.29	x	46.75	x	0.5	x	0.8	=	68.56	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	5.29	x	76.57	x	0.5	x	0.8	=	112.28	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	5.29	x	97.53	x	0.5	x	0.8	=	143.02	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	5.29	x	110.23	x	0.5	x	0.8	=	161.65	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	5.29	x	114.87	x	0.5	x	0.8	=	168.45	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	5.29	x	110.55	x	0.5	x	0.8	=	162.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	5.29	x	108.01	x	0.5	x	0.8	=	158.39	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	5.29	x	104.89	x	0.5	x	0.8	=	153.82	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	5.29	x	101.89	x	0.5	x	0.8	=	149.4	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	5.29	x	82.59	x	0.5	x	0.8	=	121.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	5.29	x	55.42	x	0.5	x	0.8	=	81.26	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	5.29	x	40.4	x	0.5	x	0.8	=	59.24	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)

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West	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 183.92 315.17 433.45 536.24 596.58 589.6 569.61 525.59 469.52 349.2 220.71 157.09 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 607.06 736.27 841.22 922.49 960.97 932.9 899.18 861.06 816.01 717.43 613.92 569.06 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.99	0.97	0.93	0.82	0.66	0.48	0.34	0.37	0.58	0.87	0.98	0.99

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m= 20.3 20.49 20.71 20.89 20.98 21 21 21 20.99 20.87 20.54 20.24 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m= 20.18 20.18 20.18 20.18 20.18 20.18 20.18 20.18 20.18 20.18 20.18 20.18 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m= 0.99 0.97 0.91 0.79 0.6 0.42 0.28 0.31 0.52 0.83 0.97 0.99 (89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m= 19.25 19.53 19.84 20.07 20.16 20.18 20.18 20.18 20.18 20.05 19.6 19.17 (90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m= 19.67 19.92 20.19 20.4 20.49 20.51 20.51 20.51 20.5 20.38 19.98 19.6 (92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m= 19.67 19.92 20.19 20.4 20.49 20.51 20.51 20.51 20.5 20.38 19.98 19.6 (93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.8	0.62	0.44	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	599.39	710.08	765.75	733.66	599.36	410.9	272.74	286.6	442.07	602.24	594.68	563.95	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1072.87	1048.22	955.3	802.5	613.36	412.32	272.85	286.8	446.85	682.44	898.81	1075.07	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	352.27	227.23	141.02	49.56	10.42	0	0	0	0	59.66	218.97	380.27	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1439.41 (98)

Space heating requirement in kWh/m²/year

18.21 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
1439.41

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 1511.38 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2102.29

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2207.4 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] = 37.19 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

51.14 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) = 51.14 (331)

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Energy for lighting (calculated in Appendix L)

342.28 (332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 863.72 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 19.3 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 883.02 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		883.02 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 26.54 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 177.64 (379)
Total CO2, kg/year	sum of (376)...(382) =		1087.2 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		13.76 (384)
El rating (section 14)			88.25 (385)

DRAFT

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-3-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	105.24 (1a) x	2.4 (2a) =	252.58 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	105.24 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	252.58 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.2	= 2.52		(26)
Windows Type 1			1.84	x 1/[1/(1.2)+0.04]	= 2.11		(27)
Windows Type 2			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 3			1.84	x 1/[1/(1.2)+0.04]	= 2.11		(27)
Windows Type 4			1.84	x 1/[1/(1.2)+0.04]	= 2.11		(27)
Windows Type 5			4.6	x 1/[1/(1.2)+0.04]	= 5.27		(27)
Walls Type1	30.46	12.88	17.58	x 0.18	= 3.16		(29)
Walls Type2	29.12	2.1	27.02	x 0.18	= 4.86		(29)
Total area of elements, m²			59.58				(31)
Party wall			42.26	x 0	= 0		(32)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 25.3 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.66 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 32.95 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=

41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68	41.68

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

74.63	74.63	74.63	74.63	74.63	74.63	74.63	74.63	74.63	74.63	74.63	74.63

Average = Sum(39)_{1...12} /12=

74.63

 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71

Average = Sum(40)_{1...12} /12=

0.71

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

2.78

 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

100.3

 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

110.33	106.31	102.3	98.29	94.28	90.27	90.27	94.28	98.29	102.3	106.31	110.33

Total = Sum(44)_{1...12} =

1203.56

 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

163.61	143.1	147.66	128.73	123.52	106.59	98.77	113.34	114.7	133.67	145.91	158.45

Total = Sum(45)_{1...12} =

1578.06

 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

24.54	21.46	22.15	19.31	18.53	15.99	14.82	17	17.2	20.05	21.89	23.77

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

 (48)

Temperature factor from Table 2b

0

 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110

 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

 (52)

Temperature factor from Table 2b

0.6

 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03

 (54)

Enter (50) or (54) in (55)

1.03

 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	218.89	193.02	202.94	182.23	178.8	160.09	154.05	168.62	168.19	188.95	199.4	213.73

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=	218.89	193.02	202.94	182.23	178.8	160.09	154.05	168.62	168.19	188.95	199.4	213.73

Output from water heater (annual)_{1...12}

2228.9

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	98.62	87.52	93.32	85.6	85.29	78.24	77.06	81.91	80.93	88.67	91.31	96.91

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15	139.15

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.31	22.48	18.28	13.84	10.34	8.73	9.44	12.27	16.46	20.9	24.4	26.01

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	264.53	267.28	260.36	245.63	227.04	209.57	197.9	195.16	202.07	216.8	235.39	252.86

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92	36.92

(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32	-111.32

(71)

Water heating gains (Table 5)

(72)m=	132.56	130.24	125.43	118.89	114.64	108.66	103.58	110.09	112.41	119.18	126.82	130.25

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	487.14	484.74	468.81	443.1	416.77	391.71	375.66	382.26	395.69	421.62	451.35	473.86

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02 (80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (80)

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West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)

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West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	70.12	137.17	225.91	329.47	403.78	413.34	393.52	338.02	262.74	162.77	87.43	57.67	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	557.26	621.91	694.72	772.58	820.55	805.05	769.18	720.28	658.43	584.39	538.79	531.53	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.94	0.8	0.59	0.43	0.48	0.75	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.33	20.44	20.62	20.83	20.96	21	21	21	20.98	20.8	20.51	20.3	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.33	20.33	20.33	20.33	20.33	20.33	20.33	20.33	20.33	20.33	20.33	20.33	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.98	0.92	0.75	0.53	0.36	0.41	0.69	0.95	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.42	19.58	19.84	20.13	20.3	20.33	20.33	20.33	20.32	20.09	19.69	19.38	(90)

fLA = Living area ÷ (4) =

0.3

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.7	19.83	20.07	20.34	20.5	20.53	20.53	20.53	20.52	20.3	19.94	19.65	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.7	19.83	20.07	20.34	20.5	20.53	20.53	20.53	20.52	20.3	19.94	19.65	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

DER WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.92	0.76	0.55	0.38	0.43	0.71	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	556.02	618.49	681.4	712.22	627.66	440.33	293.36	308.1	466.14	557.66	535.67	530.69	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1148.91	1114.47	1012.68	853.8	656.41	442.55	293.49	308.4	478.86	724.2	958.09	1153.22	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	441.11	333.3	246.47	101.94	21.39	0	0	0	0	123.91	304.14	463.16	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2035.42 (98)

Space heating requirement in kWh/m²/year

19.34 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2035.42

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 2137.19 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2228.9

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2340.35 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] = 44.78 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

68.1 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) = 68.1 (331)

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Energy for lighting (calculated in Appendix L)

446.9

(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1039.94 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 23.24 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1063.18 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1063.18 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 35.34 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 231.94 (379)
Total CO2, kg/year	sum of (376)...(382) =		1330.47 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		12.64 (384)
El rating (section 14)			88.13 (385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-3-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	86.91 (1a) x	2.4 (2a) =	208.58 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.91 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	208.58 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0	(9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0	(12)

If no draught lobby, enter 0.05, else enter 0	0	(13)

Percentage of windows and doors draught stripped	0	(14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4	(17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 2			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 3			1.84	$\times 1/[1/(1.2)+0.04]$	2.11		
Windows Type 4			4.6	$\times 1/[1/(1.2)+0.04]$	5.27		
Windows Type 5			5.29	$\times 1/[1/(1.2)+0.04]$	6.06		
Walls Type1	47.44	17.25	30.19	0.18	5.43		
Walls Type2	10.78	2.1	8.68	0.18	1.56		
Total area of elements, m²			58.22				
Party wall			48.43	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 29.27 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.28 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.55 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=

34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42	34.42

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

71.97	71.97	71.97	71.97	71.97	71.97	71.97	71.97	71.97	71.97	71.97	71.97

Average = Sum(39)_{1...12} /12=

71.97

 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83

Average = Sum(40)_{1...12} /12=

0.83

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

2.58

 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

95.5

 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

105.05	101.23	97.41	93.59	89.77	85.95	85.95	89.77	93.59	97.41	101.23	105.05

Total = Sum(44)_{1...12} =

1145.99

 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

155.78	136.25	140.6	122.58	117.62	101.49	94.05	107.92	109.21	127.27	138.93	150.87

Total = Sum(45)_{1...12} =

1502.57

 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

23.37	20.44	21.09	18.39	17.64	15.22	14.11	16.19	16.38	19.09	20.84	22.63

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

 (48)

Temperature factor from Table 2b

0

 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110

 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

 (52)

Temperature factor from Table 2b

0.6

 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03

 (54)

Enter (50) or (54) in (55)

1.03

 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

211.06	186.18	195.88	176.07	172.89	154.99	149.33	163.2	162.7	182.55	192.42	206.15

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=

211.06	186.18	195.88	176.07	172.89	154.99	149.33	163.2	162.7	182.55	192.42	206.15

Output from water heater (annual)_{1...12}

2153.41

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=

96.02	85.25	90.97	83.55	83.33	76.54	75.49	80.11	79.11	86.54	88.99	94.39

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05	129.05

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

20.79	18.47	15.02	11.37	8.5	7.18	7.75	10.08	13.53	17.18	20.05	21.37

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

233.28	235.7	229.6	216.61	200.22	184.81	174.52	172.1	178.2	191.18	207.58	222.98

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91	35.91

(69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24	-103.24

(71)

Water heating gains (Table 5)

(72)m=

129.06	126.85	122.27	116.04	112	106.31	101.47	107.67	109.87	116.32	123.6	126.86

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

444.84	442.73	428.6	405.74	382.43	360.01	345.46	351.56	363.31	386.39	412.94	432.93

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)

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North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)

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West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	80.71	157.17	260.4	387.27	484.5	501.1	474.91	400.76	304.85	186.61	100.42	66.55	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	525.55	599.91	689.01	793.01	866.93	861.11	820.37	752.32	668.16	573.01	513.36	499.48	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.73	0.53	0.39	0.44	0.71	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.22	20.35	20.57	20.82	20.96	21	21	21	20.98	20.77	20.44	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	20.23	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.69	0.47	0.32	0.37	0.64	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.18	19.37	19.69	20.03	20.2	20.23	20.23	20.23	20.21	19.97	19.5	19.13	(90)

fLA = Living area ÷ (4) =

0.4

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.77	20.04	20.35	20.5	20.53	20.54	20.54	20.52	20.29	19.87	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.77	20.04	20.35	20.5	20.53	20.54	20.54	20.52	20.29	19.87	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.88	0.7	0.49	0.35	0.4	0.67	0.94	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	523.44	594.02	666.9	701.23	609.72	424.94	283.17	297.31	448.56	536.81	508.43	498.01	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1100.97	1069.88	974.77	823.92	633.49	427.07	283.34	297.71	461.88	697.08	919.21	1104.7	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	429.68	319.78	229.06	88.34	17.69	0	0	0	0	119.24	295.77	451.38	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

1950.93 (98)

Space heating requirement in kWh/m²/year

22.45 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

1950.93

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

2048.47 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2153.41

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2261.09 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

43.1 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

56.24 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

56.24 (331)

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Energy for lighting (calculated in Appendix L)

367.2

(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1000.93 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 22.37 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1023.3 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1023.3 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 29.19 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 190.58 (379)
Total CO2, kg/year	sum of (376)...(382) =		1243.06 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		14.3 (384)
EI rating (section 14)			87.37 (385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-6-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	71.18 (1a) x	2.4 (2a) =	170.83 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.18 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.83 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			5.29	$\times 1/[1/(1.2) + 0.04]$	6.06		
Windows Type 2			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		
Windows Type 3			8.05	$\times 1/[1/(1.2) + 0.04]$	9.22		
Windows Type 4			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		
Walls Type1	39.96	17.02	22.94	0.18	4.13		
Walls Type2	5.87	2.1	3.77	0.18	0.68		
Total area of elements, m²			45.83				
Party wall			39.46	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 26.82 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.62 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 33.44 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 61.63 61.63 61.63 61.63 61.63 61.63 61.63 61.63 61.63 61.63 61.63 61.63 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87		
Average = Sum(40) _{1...12} /12=													0.87	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.27

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

88.22

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.04	93.51	89.98	86.45	82.92	79.4	79.4	82.92	86.45	89.98	93.51	97.04		
Total = Sum(44) _{1...12} =													1058.61	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.91	125.86	129.88	113.23	108.65	93.75	86.88	99.69	100.88	117.57	128.34	139.37		
Total = Sum(45) _{1...12} =													1388.01	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.59	18.88	19.48	16.98	16.3	14.06	13.03	14.95	15.13	17.64	19.25	20.9		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

199.18	175.79	185.15	166.72	163.92	147.25	142.15	154.97	154.38	172.85	181.83	194.64

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

199.18	175.79	185.15	166.72	163.92	147.25	142.15	154.97	154.38	172.85	181.83	194.64

Output from water heater (annual)_{1...12}

2038.85

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

92.07	81.79	87.41	80.44	80.35	73.97	73.11	77.37	76.34	83.31	85.47	90.56

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

17.83	15.84	12.88	9.75	7.29	6.15	6.65	8.64	11.6	14.73	17.19	18.33

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

200.04	202.11	196.88	185.74	171.69	158.48	149.65	147.57	152.81	163.94	178	191.21

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98

 (71)

Water heating gains (Table 5)

(72)m=

123.75	121.71	117.48	111.73	107.99	102.73	98.26	103.99	106.03	111.98	118.7	121.72

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

398.74	396.78	384.36	364.34	344.09	324.48	311.68	317.33	327.55	347.77	371.01	388.38

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)							
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.29</td></tr></table>	5.29	x	<table><tr><td>10.63</td></tr></table>	10.63	x	<table><tr><td>0.5</td></tr></table>	0.5	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>15.59</td></tr></table> (74)	15.59
0.77																		
5.29																		
10.63																		
0.5																		
0.8																		
15.59																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.84</td></tr></table>	1.84	x	<table><tr><td>10.63</td></tr></table>	10.63	x	<table><tr><td>0.5</td></tr></table>	0.5	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>5.42</td></tr></table> (74)	5.42
0.77																		
1.84																		
10.63																		
0.5																		
0.8																		
5.42																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.84</td></tr></table>	1.84	x	<table><tr><td>10.63</td></tr></table>	10.63	x	<table><tr><td>0.5</td></tr></table>	0.5	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>5.42</td></tr></table> (74)	5.42
0.77																		
1.84																		
10.63																		
0.5																		
0.8																		
5.42																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.29</td></tr></table>	5.29	x	<table><tr><td>20.32</td></tr></table>	20.32	x	<table><tr><td>0.5</td></tr></table>	0.5	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>29.8</td></tr></table> (74)	29.8
0.77																		
5.29																		
20.32																		
0.5																		
0.8																		
29.8																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.84</td></tr></table>	1.84	x	<table><tr><td>20.32</td></tr></table>	20.32	x	<table><tr><td>0.5</td></tr></table>	0.5	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>10.36</td></tr></table> (74)	10.36
0.77																		
1.84																		
20.32																		
0.5																		
0.8																		
10.36																		

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
East	0.9x	0.77	x	8.05	x	19.64	x	0.5	x	0.8	=	43.83	(76)
East	0.9x	0.77	x	8.05	x	38.42	x	0.5	x	0.8	=	85.73	(76)
East	0.9x	0.77	x	8.05	x	63.27	x	0.5	x	0.8	=	141.19	(76)
East	0.9x	0.77	x	8.05	x	92.28	x	0.5	x	0.8	=	205.92	(76)
East	0.9x	0.77	x	8.05	x	113.09	x	0.5	x	0.8	=	252.36	(76)
East	0.9x	0.77	x	8.05	x	115.77	x	0.5	x	0.8	=	258.34	(76)
East	0.9x	0.77	x	8.05	x	110.22	x	0.5	x	0.8	=	245.95	(76)
East	0.9x	0.77	x	8.05	x	94.68	x	0.5	x	0.8	=	211.27	(76)
East	0.9x	0.77	x	8.05	x	73.59	x	0.5	x	0.8	=	164.21	(76)
East	0.9x	0.77	x	8.05	x	45.59	x	0.5	x	0.8	=	101.73	(76)

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East	0.9x	0.77	x	8.05	x	24.49	x	0.5	x	0.8	=	54.65	(76)
East	0.9x	0.77	x	8.05	x	16.15	x	0.5	x	0.8	=	36.04	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	70.27	136.26	227.05	343.83	438.14	457.22	431.63	358.58	267.44	161.88	87.26	58.08	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	469	533.04	611.41	708.17	782.23	781.7	743.31	675.91	594.99	509.65	458.28	446.46	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.89	0.7	0.5	0.36	0.42	0.69	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.22	20.35	20.58	20.83	20.97	21	21	21	20.98	20.78	20.44	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.86	0.65	0.44	0.3	0.35	0.62	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.15	19.35	19.67	20.01	20.17	20.19	20.2	20.2	20.18	19.95	19.47	19.09	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.58	19.75	20.04	20.34	20.49	20.52	20.52	20.52	20.5	20.28	19.86	19.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.58	19.75	20.04	20.34	20.49	20.52	20.52	20.52	20.5	20.28	19.86	19.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.86	0.67	0.46	0.32	0.37	0.65	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	466.16	525.7	586.11	610.47	524.23	363	241.31	253.43	384.12	469.74	451.95	444.43	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	941.54	915.23	834.23	705.14	541.54	364.54	241.44	253.74	394.4	596.42	786.4	944.62	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	353.68	261.76	184.6	68.17	12.88	0	0	0	0	94.25	240.81	372.14	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1588.28 (98)

Space heating requirement in kWh/m²/year

22.31 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

DER WorkSheet: New dwelling design stage

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)
<i>The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.</i>			
Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		kWh/year	
Annual space heating requirement		1588.28	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1667.69	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2038.85	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2140.79	(310a)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	38.08	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.06	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	46.06	(331)
Energy for lighting (calculated in Appendix L)		314.94	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	= 884.55 (367)
Electrical energy for heat distribution	[(313) x	0.52	= 19.77 (372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)		= 904.32 (373)
CO2 associated with space heating (secondary)	(309) x	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	= 0 (375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		904.32 (376)
CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	= 23.9 (378)

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CO2 associated with electricity for lighting	(332))) x	0.52	=	163.45	(379)
Total CO2, kg/year	sum of (376)...(382) =			1091.68	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.34	(384)
El rating (section 14)				87.41	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-6-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	69.44 (1a) x	2.4 (2a) =	166.66 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	69.44 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	166.66 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0 +	0 +	0 =	0 x 40 =	0 (6a)
Number of open flues	0 +	0 +	0 =	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 2			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		
Windows Type 3			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 4			4.6	$\times 1/[1/(1.2) + 0.04]$	5.27		
Windows Type 5			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Walls Type1	43.96	14.72	29.24	0.18	5.26		
Walls Type2	32.4	2.1	30.3	0.18	5.45		
Total area of elements, m²			76.36				
Party wall			14.75	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 30.09 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.01 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 39.1 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=

27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

66.6	66.6	66.6	66.6	66.6	66.6	66.6	66.6	66.6	66.6	66.6	66.6

Average = Sum(39)_{1...12} /12=

66.6 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96

Average = Sum(40)_{1...12} /12=

0.96 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

2.23 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

87.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

95.94	92.45	88.97	85.48	81.99	78.5	78.5	81.99	85.48	88.97	92.45	95.94

Total = Sum(44)_{1...12} =

1046.65 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

142.28	124.44	128.41	111.95	107.42	92.7	85.9	98.57	99.74	116.24	126.89	137.79

Total = Sum(45)_{1...12} =

1372.32 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

21.34	18.67	19.26	16.79	16.11	13.9	12.88	14.78	14.96	17.44	19.03	20.67

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03 (52)

Temperature factor from Table 2b

0.6 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03 (54)

Enter (50) or (54) in (55)

1.03 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	197.56	174.37	183.69	165.44	162.7	146.19	141.17	153.84	153.24	171.52	180.38	193.07

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=	197.56	174.37	183.69	165.44	162.7	146.19	141.17	153.84	153.24	171.52	180.38	193.07

Output from water heater (annual)_{1...12}

2023.16

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.53	81.32	86.92	80.02	79.94	73.62	72.78	76.99	75.96	82.87	84.98	90.04

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.47	15.52	12.62	9.55	7.14	6.03	6.52	8.47	11.37	14.43	16.85	17.96

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	195.99	198.02	192.9	181.98	168.21	155.27	146.62	144.59	149.71	160.62	174.4	187.34

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16	34.16

(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3	-89.3

(71)

Water heating gains (Table 5)

(72)m=	123.02	121.01	116.83	111.14	107.44	102.24	97.82	103.49	105.5	111.39	118.03	121.02

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	392.97	391.03	378.83	359.16	339.29	320.03	307.45	313.03	323.07	342.93	365.76	382.8

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (76)

(76)

(76)

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East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)

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South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	149.28	254.06	345.55	422.33	466	459.07	444.11	412.37	372.43	280.37	178.8	127.74	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	542.25	645.09	724.38	781.49	805.28	779.1	751.55	725.4	695.5	623.3	544.56	510.54	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.87	0.72	0.54	0.39	0.42	0.64	0.89	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.2	20.38	20.61	20.82	20.95	20.99	21	21	20.98	20.81	20.45	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.83	0.67	0.47	0.31	0.34	0.57	0.86	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.06	19.33	19.64	19.92	20.07	20.11	20.12	20.12	20.1	19.92	19.43	18.98	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.51	19.75	20.03	20.28	20.42	20.46	20.47	20.47	20.45	20.27	19.84	19.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.51	19.75	20.03	20.28	20.42	20.46	20.47	20.47	20.45	20.27	19.84	19.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.93	0.84	0.69	0.5	0.34	0.37	0.59	0.87	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	535.56	625.42	672.93	656.56	553.83	387.03	257.39	270.47	413.66	540.59	529.07	505.88	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1013.1	988.84	900.83	757.91	580.86	390.54	257.73	271.02	423.13	644.32	848.23	1015.38	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	355.29	244.22	169.56	72.97	20.11	0	0	0	0	77.17	229.79	379.07	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1548.19 (98)

Space heating requirement in kWh/m²/year

22.3 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
1548.19

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 1625.6 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2023.16

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2124.32 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] = 37.5 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

44.93 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) = 44.93 (331)

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Energy for lighting (calculated in Appendix L)

308.57 (332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 870.95 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 19.46 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 890.41 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		890.41 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 23.32 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 160.15 (379)
Total CO2, kg/year	sum of (376)...(382) =		1073.88 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		15.46 (384)
El rating (section 14)			87.43 (385)

DRAFT

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-6-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	71.53 (1a) x	2.4 (2a) =	171.67 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.53 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.67 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			5.29	$\times 1/[1/(1.2) + 0.04]$	6.06		
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 3			5.29	$\times 1/[1/(1.2) + 0.04]$	6.06		
Windows Type 4			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Walls Type1	38.18	16.1	22.08	0.18	3.97		
Walls Type2	15.79	2.1	13.69	0.18	2.46		
Total area of elements, m²			53.97				
Party wall			38.51	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 27.39 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 34.7 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33	28.33

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 63.03 63.03 63.03 63.03 63.03 63.03 63.03 63.03 63.03 63.03 63.03 63.03 (39)

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Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88		
Average = Sum(40) _{1...12} /12=													0.88	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.28

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

88.41

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.26	93.72	90.18	86.65	83.11	79.57	79.57	83.11	86.65	90.18	93.72	97.26		
Total = Sum(44) _{1...12} =													1060.97	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.23	126.14	130.17	113.48	108.89	93.96	87.07	99.91	101.11	117.83	128.62	139.68		
Total = Sum(45) _{1...12} =													1391.09	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.63	18.92	19.53	17.02	16.33	14.09	13.06	14.99	15.17	17.67	19.29	20.95		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

DER WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.5	176.07	185.44	166.98	164.17	147.46	142.35	155.19	154.6	173.11	182.12	194.95	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.5	176.07	185.44	166.98	164.17	147.46	142.35	155.19	154.6	173.11	182.12	194.95	
Output from water heater (annual) _{1...12}												2041.93	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	92.18	81.88	87.5	80.53	80.43	74.04	73.17	77.44	76.41	83.4	85.56	90.66	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	114.13	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.91	15.9	12.93	9.79	7.32	6.18	6.68	8.68	11.65	14.79	17.26	18.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.84	202.93	197.67	186.49	172.38	159.11	150.25	148.17	153.42	164.6	178.71	191.98	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	34.41	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	-91.31	(71)

Water heating gains (Table 5)

(72)m=	123.89	121.85	117.61	111.84	108.1	102.83	98.35	104.09	106.13	112.1	118.84	121.86	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	399.88	397.92	385.46	365.37	345.04	325.36	312.52	318.18	328.44	348.73	372.05	389.48	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	5.29	x	46.75	x	0.5	x	0.8	=	68.56 (78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77 (78)
South	0.9x	0.77	x	5.29	x	76.57	x	0.5	x	0.8	=	112.28 (78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58 (78)
South	0.9x	0.77	x	5.29	x	97.53	x	0.5	x	0.8	=	143.02 (78)

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South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	5.29	x	110.23	x	0.5	x	0.8	=	161.65	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	5.29	x	114.87	x	0.5	x	0.8	=	168.45	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	5.29	x	110.55	x	0.5	x	0.8	=	162.11	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	5.29	x	108.01	x	0.5	x	0.8	=	158.39	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	5.29	x	104.89	x	0.5	x	0.8	=	153.82	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	5.29	x	101.89	x	0.5	x	0.8	=	149.4	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	5.29	x	82.59	x	0.5	x	0.8	=	121.1	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	5.29	x	55.42	x	0.5	x	0.8	=	81.26	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	5.29	x	40.4	x	0.5	x	0.8	=	59.24	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)

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West $0.9 \times \boxed{0.77} \times \boxed{5.29} \times \boxed{16.15} \times \boxed{0.5} \times \boxed{0.8} = \boxed{23.68}$ (80)

West $0.9 \times \boxed{0.77} \times \boxed{2.76} \times \boxed{16.15} \times \boxed{0.5} \times \boxed{0.8} = \boxed{12.36}$ (80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=

148.15	256.59	358.83	451.9	508.69	505.02	486.97	445.33	391.57	286.02	178.31	126.19

 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=

548.03	654.51	744.29	817.27	853.73	830.38	799.49	763.51	720	634.75	550.36	515.67

 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.98	0.93	0.83	0.66	0.48	0.35	0.38	0.59	0.88	0.98	0.99

 (86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=

20.3	20.48	20.7	20.88	20.97	21	21	21	20.99	20.86	20.53	20.25

 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=

20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18	20.18

 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=

0.99	0.97	0.92	0.8	0.61	0.42	0.28	0.31	0.53	0.84	0.97	0.99

 (89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=

19.26	19.52	19.82	20.06	20.16	20.18	20.18	20.18	20.18	20.04	19.6	19.18

 (90)

fLA = Living area ÷ (4) =

0.4

 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=

19.67	19.9	20.17	20.39	20.49	20.51	20.51	20.51	20.5	20.37	19.97	19.61

 (92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=

19.67	19.9	20.17	20.39	20.49	20.51	20.51	20.51	20.5	20.37	19.97	19.61

 (93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=

0.99	0.97	0.92	0.8	0.63	0.45	0.31	0.34	0.55	0.85	0.97	0.99

 (94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=

541.18	632.84	682.28	657.9	540.22	370.99	246.33	258.83	398.68	538.7	533.74	511.01

 (95)

Monthly average external temperature from Table 8

(96)m=

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2

 (96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=

968.9	945.67	861.66	724.2	553.79	372.36	246.44	259.03	403.49	615.73	811.33	971.1

 (97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=

318.22	210.22	133.46	47.74	10.1	0	0	0	0	57.31	199.87	342.31

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

1319.22

 (98)

Space heating requirement in kWh/m²/year

18.44

 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

DER WorkSheet: New dwelling design stage

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)
<i>The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.</i>			
Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		kWh/year	
Annual space heating requirement		1319.22	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1385.18	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2041.93	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2144.03	(310a)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	35.29	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.29	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	46.29	(331)
Energy for lighting (calculated in Appendix L)		316.21	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel	93	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	= 819.69 (367)
Electrical energy for heat distribution	[(313) x	0.52	= 18.32 (372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)		= 838 (373)
CO2 associated with space heating (secondary)	(309) x	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	= 0 (375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		838 (376)
CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	= 24.02 (378)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for lighting	(332))) x	0.52	=	164.11	(379)
Total CO2, kg/year	sum of (376)...(382) =			1026.14	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			14.35	(384)
El rating (section 14)				88.2	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-6-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	50.7 (1a) x	2.4 (2a) =	121.68 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.7 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.68 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0 +	0 +	0 =	0 x 40 =	0 (6a)
Number of open flues	0 +	0 +	0 =	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 3			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		
Walls Type1	16.08	6.44	9.64	0.18	1.74		
Walls Type2	13.61	2.1	11.51	0.18	2.07		
Total area of elements, m²			29.69				
Party wall			43.39	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 13.7 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.35 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 18.06 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13
Average = Sum(39) _{1...12} /12=												38.13 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75		
	Average = Sum(40) _{1...12} /12=												0.75	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

1.71

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

74.83

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	82.31	79.32	76.33	73.33	70.34	67.35	67.35	70.34	73.33	76.33	79.32	82.31		
	Total = Sum(44) _{1...12} =												897.96	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22		
	Total = Sum(45) _{1...12} =												1177.36	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.31	16.01	16.53	14.41	13.82	11.93	11.05	12.68	12.84	14.96	16.33	17.73		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

177.34	156.69	165.44	149.54	147.44	133.02	128.97	139.84	139.07	155	162.35	173.49

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

177.34	156.69	165.44	149.54	147.44	133.02	128.97	139.84	139.07	155	162.35	173.49

Output from water heater (annual)_{1...12}

1828.2

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

84.81	75.44	80.85	74.73	74.86	69.24	68.72	72.34	71.25	77.38	78.99	83.53

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

14.14	12.56	10.22	7.73	5.78	4.88	5.27	6.86	9.2	11.68	13.64	14.54

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

149.05	150.6	146.7	138.4	127.93	118.08	111.51	109.96	113.86	122.16	132.63	142.48

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43

 (71)

Water heating gains (Table 5)

(72)m=

113.99	112.26	108.67	103.79	100.62	96.16	92.37	97.23	98.96	104.01	109.71	112.27

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

325.85	324.08	314.25	298.59	283	267.79	257.82	262.71	270.68	286.51	304.64	317.94

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)							
West	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.84</td></tr></table>	1.84	x	<table><tr><td>19.64</td></tr></table>	19.64	x	<table><tr><td>0.5</td></tr></table>	0.5	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>10.02</td></tr></table> (80)	10.02
0.77																		
1.84																		
19.64																		
0.5																		
0.8																		
10.02																		
West	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.76</td></tr></table>	2.76	x	<table><tr><td>19.64</td></tr></table>	19.64	x	<table><tr><td>0.5</td></tr></table>	0.5	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>15.03</td></tr></table> (80)	15.03
0.77																		
2.76																		
19.64																		
0.5																		
0.8																		
15.03																		
West	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.84</td></tr></table>	1.84	x	<table><tr><td>19.64</td></tr></table>	19.64	x	<table><tr><td>0.5</td></tr></table>	0.5	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>10.02</td></tr></table> (80)	10.02
0.77																		
1.84																		
19.64																		
0.5																		
0.8																		
10.02																		
West	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.84</td></tr></table>	1.84	x	<table><tr><td>38.42</td></tr></table>	38.42	x	<table><tr><td>0.5</td></tr></table>	0.5	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>19.6</td></tr></table> (80)	19.6
0.77																		
1.84																		
38.42																		
0.5																		
0.8																		
19.6																		
West	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.76</td></tr></table>	2.76	x	<table><tr><td>38.42</td></tr></table>	38.42	x	<table><tr><td>0.5</td></tr></table>	0.5	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>29.39</td></tr></table> (80)	29.39
0.77																		
2.76																		
38.42																		
0.5																		
0.8																		
29.39																		

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 35.06 68.59 112.95 164.74 201.89 206.67 196.76 169.01 131.37 81.38 43.72 28.83 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 360.91 392.67 427.2 463.33 484.89 474.46 454.57 431.72 402.05 367.89 348.36 346.78 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.99	0.98	0.96	0.88	0.71	0.51	0.37	0.41	0.64	0.91	0.98	0.99

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m= 20.44 20.55 20.71 20.89 20.98 21 21 21 20.99 20.87 20.62 20.41 (87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.85	0.66	0.46	0.31	0.34	0.58	0.88	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.56	19.7	19.94	20.17	20.28	20.29	20.29	20.29	20.29	20.16	19.82	19.51	(90)

fLA = Living area ÷ (4) =	0.5	(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20	20.13	20.33	20.53	20.63	20.65	20.65	20.65	20.64	20.52	20.22	19.96	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20	20.13	20.33	20.53	20.63	20.65	20.65	20.65	20.64	20.52	20.22	19.96	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.86	0.68	0.48	0.34	0.37	0.61	0.89	0.98	0.99	(94)

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	357.01	384.6	405.28	397.24	331.86	229.87	154.29	161.87	246.21	327.11	339.99	343.87	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm, W = [(39)m × ((93)m – (96)m)]

(97)m=	598.69	580.58	527.29	443.51	340.4	230.55	154.34	161.96	249.38	378.18	500.37	600.9	(97)

Space heating requirement for each month, kWh/month = 0.024 × [(97)m – (95)m] × (41)m

(98)m=	179.81	131.7	90.77	33.31	6.36	0	0	0	0	38	115.47	191.23	(98)

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	786.65	(98)

Space heating requirement in kWh/m²/year

15.52	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)

Fraction of space heat from community system 1 – (301) =

1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1	(303a)

Fraction of total space heat from Community boilers

(302) × (303a) =	1	(304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)

Distribution loss factor (Table 12c) for community heating system

1.05	(306)

Space heating

Annual space heating requirement

kWh/year

786.65

Space heat from Community boilers

(98) × (304a) × (305) × (306) =

825.98	(307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0	(308)

DER WorkSheet: New dwelling design stage

Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)
Water heating			
Annual water heating requirement		1828.2	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	1919.61	(310a)
Electricity used for heat distribution	$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$	27.46	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		32.81	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	32.81	(331)
Energy for lighting (calculated in Appendix L)		249.8	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		
			93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 637.69 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 14.25 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 651.94 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		651.94 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 17.03 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 129.64 (379)
Total CO2, kg/year	sum of (376)...(382) =		798.61 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		15.75 (384)
EI rating (section 14)			88.82 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-6-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	71.03 (1a) x	2.4 (2a) =	170.47 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.03 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.47 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		
Windows Type 2			4.6	$\times 1/[1/(1.2) + 0.04]$	5.27		
Windows Type 3			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Walls Type1	25.33	9.2	16.13	0.18	2.9		
Walls Type2	13.71	2.1	11.61	0.18	2.09		
Total area of elements, m²			39.04				
Party wall			52.54	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 18.05 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.04 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 24.09 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	52.22	52.22	52.22	52.22	52.22	52.22	52.22	52.22	52.22	52.22	52.22	52.22
Average = Sum(39) _{1...12} /12=												52.22 (39)

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Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74		
Average = Sum(40) _{1...12} /12=													0.74	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.27

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

88.13

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.95	93.42	89.9	86.37	82.85	79.32	79.32	82.85	86.37	89.9	93.42	96.95		
Total = Sum(44) _{1...12} =													1057.6	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.77	125.74	129.75	113.12	108.54	93.66	86.79	99.6	100.79	117.46	128.21	139.23		
Total = Sum(45) _{1...12} =													1386.68	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.57	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.88		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.05	175.67	185.03	166.62	163.82	147.16	142.07	154.87	154.28	172.73	181.71	194.51	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.05	175.67	185.03	166.62	163.82	147.16	142.07	154.87	154.28	172.73	181.71	194.51	
Output from water heater (annual) _{1...12}												2037.52	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	92.02	81.75	87.36	80.41	80.31	73.94	73.08	77.34	76.31	83.28	85.43	90.52	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.87	16.76	13.63	10.32	7.71	6.51	7.04	9.15	12.28	15.59	18.19	19.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.69	201.76	196.54	185.42	171.39	158.2	149.39	147.32	152.54	163.66	177.69	190.88	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	(71)

Water heating gains (Table 5)

(72)m=	123.69	121.65	117.43	111.68	107.95	102.69	98.23	103.95	105.98	111.93	118.65	121.66	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	399.31	397.24	384.66	364.48	344.11	324.47	311.72	317.48	327.86	348.24	371.59	389	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)

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West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 50.09 97.98 161.36 235.34 288.41 295.24 281.08 241.45 187.67 116.26 62.45 41.19 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 449.4 495.22 546.02 599.82 632.53 619.71 592.8 558.92 515.53 464.5 434.05 430.19 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	1	0.99	0.97	0.9	0.74	0.54	0.39	0.43	0.68	0.94	0.99	1

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m= 20.39 20.5 20.68 20.87 20.97 21 21 21 20.99 20.85 20.58 20.36 (87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.31	20.31	20.31	20.31	20.31	20.31	20.31	20.31	20.31	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.88	0.69	0.48	0.33	0.37	0.62	0.91	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.5	19.65	19.9	20.16	20.29	20.31	20.31	20.31	20.3	20.14	19.76	19.45	(90)

fLA = Living area ÷ (4) =	0.4	(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.85	19.99	20.21	20.45	20.56	20.58	20.59	20.59	20.58	20.42	20.09	19.81	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.85	19.99	20.21	20.45	20.56	20.58	20.59	20.59	20.58	20.42	20.09	19.81	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.88	0.71	0.5	0.35	0.39	0.65	0.92	0.99	1	(94)

Useful gains, hmGm, W = (94)m x (84)m

(95)m=	446.71	488.88	525.97	528.86	448.98	311.41	208.06	218.42	332.62	426.54	427.88	428.26	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm, W = [(39)m x [(93)m – (96)m]

(97)m=	812.19	787.93	716	602.87	462.69	312.46	208.12	218.56	338.15	512.8	678.19	815.14	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	271.92	200.97	141.38	53.28	10.2	0	0	0	0	64.17	180.23	287.84	(98)

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	1209.99	(98)

Space heating requirement in kWh/m²/year

17.03	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)

Fraction of space heat from community system 1 – (301) =

1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1	(303a)

Fraction of total space heat from Community boilers

(302) x (303a) =	1	(304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)

Distribution loss factor (Table 12c) for community heating system

1.05	(306)

Space heating

Annual space heating requirement

kWh/year

1209.99

Space heat from Community boilers

(98) x (304a) x (305) x (306) =	1270.49	(307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0	(308)

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Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)
Water heating			
Annual water heating requirement		2037.52	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	2139.39	(310a)
Electricity used for heat distribution	$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$	34.1	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		45.96	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	45.96	(331)
Energy for lighting (calculated in Appendix L)		333.28	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		
			93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 791.97 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 17.7 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 809.67 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		809.67 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 23.85 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 172.97 (379)
Total CO2, kg/year	sum of (376)...(382) =		1006.5 (383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =		14.17 (384)
EI rating (section 14)			88.38 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-6-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	74.5 (1a) x	2.4 (2a) =	178.8 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	178.8 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			4.6	$\times 1/[1/(1.2) + 0.04]$	5.27		
Windows Type 2			5.29	$\times 1/[1/(1.2) + 0.04]$	6.06		
Windows Type 3			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 4			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 5			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		
Walls Type1	39.17	17.25	21.92	0.18	3.95		
Walls Type2	5.47	2.1	3.37	0.18	0.61		
Total area of elements, m²			44.64				
Party wall			51.4	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 26.82 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.09 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 33.92 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=

29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

63.42	63.42	63.42	63.42	63.42	63.42	63.42	63.42	63.42	63.42	63.42	63.42

Average = Sum(39)_{1...12} / 12 =

63.42 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85

Average = Sum(40)_{1...12} / 12 =

0.85 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

2.35 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

90.02 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

99.02	95.42	91.82	88.22	84.62	81.02	81.02	84.62	88.22	91.82	95.42	99.02

Total = Sum(44)_{1...12} =

1080.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

146.84	128.43	132.53	115.54	110.87	95.67	88.65	101.73	102.94	119.97	130.96	142.21

Total = Sum(45)_{1...12} =

1416.34 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

22.03	19.26	19.88	17.33	16.63	14.35	13.3	15.26	15.44	18	19.64	21.33

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03 (52)

Temperature factor from Table 2b

0.6 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03 (54)

Enter (50) or (54) in (55)

1.03 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.12	178.36	187.81	169.04	166.14	149.16	143.93	157	156.44	175.25	184.45	197.49

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=	202.12	178.36	187.81	169.04	166.14	149.16	143.93	157	156.44	175.25	184.45	197.49

Output from water heater (annual)_{1...12}

2067.18

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.05	82.65	88.29	81.21	81.08	74.6	73.7	78.05	77.02	84.11	86.34	91.51

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.5	16.44	13.37	10.12	7.56	6.39	6.9	8.97	12.04	15.29	17.84	19.02

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	207.56	209.72	204.29	192.74	178.15	164.44	155.28	153.13	158.56	170.11	184.7	198.41

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75

(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01

(71)

Water heating gains (Table 5)

(72)m=	125.06	122.98	118.67	112.8	108.98	103.62	99.06	104.9	106.98	113.05	119.91	122.99

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	409.39	407.39	394.58	373.9	352.95	332.7	319.49	325.25	335.83	356.7	380.71	398.67

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59 (74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14 (74)

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North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)

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West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	73.82	143.33	238.41	359.1	455.14	473.73	447.72	373.65	280.31	170.24	91.72	60.97	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	483.2	550.72	632.99	733.01	808.09	806.42	767.21	698.9	616.14	526.94	472.43	459.64	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.88	0.7	0.5	0.36	0.42	0.69	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.37	20.59	20.84	20.97	21	21	21	20.98	20.78	20.45	20.19	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.86	0.65	0.44	0.3	0.35	0.62	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.18	19.38	19.7	20.03	20.18	20.21	20.21	20.21	20.19	19.97	19.5	19.12	(90)

fLA = Living area ÷ (4) =

0.4

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.77	20.06	20.36	20.5	20.52	20.53	20.52	20.51	20.29	19.88	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.77	20.06	20.36	20.5	20.52	20.53	20.52	20.51	20.29	19.88	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.86	0.67	0.46	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	480.46	543.41	607.08	631.65	540.9	374.15	248.81	261.3	396.48	486.02	466.21	457.7	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	970.23	943.19	859.74	726.57	557.87	375.62	248.93	261.6	406.42	614.66	810.38	973.41	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	364.39	268.65	187.98	68.35	12.63	0	0	0	0	95.71	247.8	383.69	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

1629.18	(98)

Space heating requirement in kWh/m²/year

21.87	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)

Fraction of space heat from community system 1 – (301) =

1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1	(303a)

Fraction of total space heat from Community boilers (302) x (303a) =

1	(304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)

Distribution loss factor (Table 12c) for community heating system

1.05	(306)

Space heating

Annual space heating requirement kWh/year

1629.18	(307a)

Space heat from Community boilers (98) x (304a) x (305) x (306) =

1710.64	(307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0	(308)

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) =

0	(309)

Water heating

Annual water heating requirement

2067.18	(310a)

If DHW from community scheme:

Water heat from Community boilers (64) x (303a) x (305) x (306) =

2170.54	(310a)

Electricity used for heat distribution 0.01 x [(307a)...(307e) + (310a)...(310e)] =

38.81	(313)

Cooling System Energy Efficiency Ratio

0	(314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) =

0	(315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

48.21	(330a)

warm air heating system fans

0	(330b)

pump for solar water heating

0	(330g)

Total electricity for the above, kWh/year = (330a) + (330b) + (330g) =

48.21	(331)

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Energy for lighting (calculated in Appendix L)

326.8

(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 901.43 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 20.14 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 921.58 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		921.58 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 25.02 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 169.61 (379)
Total CO2, kg/year	sum of (376)...(382) =		1116.2 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		14.98 (384)
EI rating (section 14)			87.48 (385)

DRAFT

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-8-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	71.18 (1a) x	2.4 (2a) =	170.83 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.18 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.83 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0 +	0 +	0 =	0 x 40 =	0 (6a)
Number of open flues	0 +	0 +	0 =	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			1.84	$\times 1/[1/(1.2)+0.04]$	2.11		
Windows Type 2			5.29	$\times 1/[1/(1.2)+0.04]$	6.06		
Windows Type 3			1.84	$\times 1/[1/(1.2)+0.04]$	2.11		
Windows Type 4			8.05	$\times 1/[1/(1.2)+0.04]$	9.22		
Walls Type1	39.96	17.02	22.94	0.18	4.13		
Walls Type2	5.87	2.1	3.77	0.18	0.68		
Roof	71.18	0	71.18	0.11	7.83		
Total area of elements, m²			117.01				
Party wall			39.46	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 34.65 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 45.22 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=

28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19	28.19

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

73.4	73.4	73.4	73.4	73.4	73.4	73.4	73.4	73.4	73.4	73.4	73.4

Average = Sum(39)_{1...12} /12=

73.4

 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03

Average = Sum(40)_{1...12} /12=

1.03

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
97.04	93.51	89.98	86.45	82.92	79.4	79.4	82.92	86.45	89.98	93.51	97.04

Total = Sum(44)_{1...12} =

1058.61

 (44)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

97.04	93.51	89.98	86.45	82.92	79.4	79.4	82.92	86.45	89.98	93.51	97.04

Total = Sum(44)_{1...12} =

1058.61

 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

143.91	125.86	129.88	113.23	108.65	93.75	86.88	99.69	100.88	117.57	128.34	139.37

Total = Sum(45)_{1...12} =

1388.01

 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

21.59	18.88	19.48	16.98	16.3	14.06	13.03	14.95	15.13	17.64	19.25	20.9

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

Temperature factor from Table 2b

Energy lost from water storage, kWh/year

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

If community heating see section 4.3

Volume factor from Table 2a

Temperature factor from Table 2b

Energy lost from water storage, kWh/year

Enter (50) or (54) in (55)

Water storage loss calculated for each month

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

199.18	175.79	185.15	166.72	163.92	147.25	142.15	154.97	154.38	172.85	181.83	194.64

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=

199.18	175.79	185.15	166.72	163.92	147.25	142.15	154.97	154.38	172.85	181.83	194.64

Output from water heater (annual)_{1...12}

2038.85

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=

92.07	81.79	87.41	80.44	80.35	73.97	73.11	77.37	76.34	83.31	85.47	90.56

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

17.83	15.84	12.88	9.75	7.29	6.15	6.65	8.64	11.6	14.73	17.19	18.33

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

200.04	202.11	196.88	185.74	171.69	158.48	149.65	147.57	152.81	163.94	178	191.21

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37

(69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98

(71)

Water heating gains (Table 5)

(72)m=

123.75	121.71	117.48	111.73	107.99	102.73	98.26	103.99	106.03	111.98	118.7	121.72

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

398.74	396.78	384.36	364.34	344.09	324.48	311.68	317.33	327.55	347.77	371.01	388.38

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)

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North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
East	0.9x	0.77	x	8.05	x	19.64	x	0.5	x	0.8	=	43.83	(76)
East	0.9x	0.77	x	8.05	x	38.42	x	0.5	x	0.8	=	85.73	(76)
East	0.9x	0.77	x	8.05	x	63.27	x	0.5	x	0.8	=	141.19	(76)
East	0.9x	0.77	x	8.05	x	92.28	x	0.5	x	0.8	=	205.92	(76)
East	0.9x	0.77	x	8.05	x	113.09	x	0.5	x	0.8	=	252.36	(76)
East	0.9x	0.77	x	8.05	x	115.77	x	0.5	x	0.8	=	258.34	(76)
East	0.9x	0.77	x	8.05	x	110.22	x	0.5	x	0.8	=	245.95	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	8.05	x	94.68	x	0.5	x	0.8	=	211.27	(76)
East	0.9x	0.77	x	8.05	x	73.59	x	0.5	x	0.8	=	164.21	(76)
East	0.9x	0.77	x	8.05	x	45.59	x	0.5	x	0.8	=	101.73	(76)
East	0.9x	0.77	x	8.05	x	24.49	x	0.5	x	0.8	=	54.65	(76)
East	0.9x	0.77	x	8.05	x	16.15	x	0.5	x	0.8	=	36.04	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	70.27	136.26	227.05	343.83	438.14	457.22	431.63	358.58	267.44	161.88	87.26	58.08	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	469	533.04	611.41	708.17	782.23	781.7	743.31	675.91	594.99	509.65	458.28	446.46	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.78	0.59	0.43	0.49	0.77	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.98	20.12	20.37	20.68	20.91	20.98	21	20.99	20.94	20.63	20.24	19.94	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.73	0.51	0.34	0.4	0.69	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.7	18.9	19.27	19.7	19.97	20.05	20.06	20.06	20.01	19.64	19.08	18.64	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.21	19.39	19.71	20.09	20.34	20.42	20.43	20.43	20.38	20.03	19.54	19.16	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.21	19.39	19.71	20.09	20.34	20.42	20.43	20.43	20.38	20.03	19.54	19.16	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.97	0.9	0.75	0.54	0.38	0.44	0.72	0.94	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	466.43	526.98	592.48	638.26	583.39	420.17	280.49	294.1	429.31	480.68	453.03	444.56	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1094.29	1063.58	969.52	821.61	634.53	427.35	281.34	295.9	460.91	692.48	913.15	1097.91	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	467.13	360.6	280.51	132.01	38.04	0	0	0	0	157.58	331.29	486.09	(98)

Total per year (kWh/year) = Sum(98)1...5,9...12 = 2253.26 (99)

Space heating requirement in kWh/m²/year

31.66 (99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

2253.26

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

2365.92 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2038.85

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2140.79 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

45.07 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

46.06 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

46.06 (331)

Energy for lighting (calculated in Appendix L)

314.94 (332)

12b. CO2 Emissions – Community heating scheme

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%)

If there is CHP using two fuels repeat (363) to (366) for the second fuel

93 (367a)

CO2 associated with heat source 1

[(307b)+(310b)] x 100 ÷ (367b) x

0.22

=

1046.72 (367)

Electrical energy for heat distribution

[(313) x

0.52

=

23.39 (372)

Total CO2 associated with community systems

(363)...(366) + (368)...(372)

=

1070.11 (373)

CO2 associated with space heating (secondary)

(309) x

0

=

0 (374)

CO2 associated with water from immersion heater or instantaneous heater

(312) x

0.22

=

0 (375)

Total CO2 associated with space and water heating

(373) + (374) + (375) =

1070.11 (376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	=	23.9	(378)
CO2 associated with electricity for lighting	(332)) x	0.52	=	163.45	(379)
Total CO2, kg/year	sum of (376)...(382) =			1257.47	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			17.67	(384)
El rating (section 14)				85.5	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-8-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	71.42 (1a) x	2.4 (2a) =	171.41 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.42 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.41 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 3			4.6	$\times 1/[1/(1.2) + 0.04]$	5.27		
Walls Type1	28.74	10.12	18.62	0.18	3.35		
Walls Type2	43.06	2.1	40.96	0.18	7.37		
Roof	17.74	0	17.74	0.11	1.95		
Total area of elements, m²			89.54				
Party wall			14.79	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 26.78 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.63 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.41 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28	28.28

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 65.69 65.69 65.69 65.69 65.69 65.69 65.69 65.69 65.69 65.69 65.69 65.69

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92		
Average = Sum(40) _{1...12} /12=													0.92	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.28

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

88.35

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.19	93.65	90.12	86.59	83.05	79.52	79.52	83.05	86.59	90.12	93.65	97.19		
Total = Sum(44) _{1...12} =													1060.23	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.13	126.05	130.08	113.4	108.81	93.9	87.01	99.85	101.04	117.75	128.53	139.58		
Total = Sum(45) _{1...12} =													1390.13	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.62	18.91	19.51	17.01	16.32	14.08	13.05	14.98	15.16	17.66	19.28	20.94		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.4	175.98	185.35	166.9	164.09	147.39	142.29	155.12	154.53	173.03	182.03	194.86	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.4	175.98	185.35	166.9	164.09	147.39	142.29	155.12	154.53	173.03	182.03	194.86	
Output from water heater (annual) _{1...12}												2040.97	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	92.14	81.85	87.47	80.5	80.4	74.02	73.15	77.42	76.39	83.37	85.53	90.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114	114	114	114	114	114	114	114	114	114	114	114	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.61	16.53	13.44	10.18	7.61	6.42	6.94	9.02	12.11	15.37	17.94	19.13	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	200.59	202.67	197.42	186.26	172.16	158.91	150.06	147.98	153.23	164.39	178.49	191.74	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	-91.2	(71)

Water heating gains (Table 5)

(72)m=	123.85	121.81	117.57	111.81	108.07	102.8	98.32	104.06	106.1	112.06	118.79	121.82	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	400.25	398.21	385.64	365.45	345.04	325.34	312.53	318.26	328.64	349.03	372.43	389.89	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d			Area m ²	Flux Table 6a			g_ Table 6b	FF Table 6c			Gains (W)	
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)

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East	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=

55.1	107.78	177.5	258.87	317.25	324.77	309.19	265.59	206.44	127.89	68.7	45.31

 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=

455.35	505.99	563.14	624.32	662.29	650.11	621.72	583.86	535.07	476.92	441.13	435.19

 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.99	0.98	0.94	0.82	0.63	0.46	0.51	0.78	0.96	0.99	1

 (86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=

20.12	20.24	20.45	20.71	20.91	20.98	21	21	20.95	20.69	20.35	20.08

 (87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.77	0.55	0.37	0.42	0.71	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.15	19.45	19.82	20.06	20.14	20.15	20.15	20.11	19.8	19.31	18.92	(90)

fLA = Living area ÷ (4) =	0.4	(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.43	19.58	19.85	20.18	20.4	20.48	20.49	20.49	20.45	20.15	19.72	19.38	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.43	19.58	19.85	20.18	20.4	20.48	20.49	20.49	20.45	20.15	19.72	19.38	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.92	0.79	0.58	0.41	0.46	0.73	0.95	0.99	1	(94)

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	453.11	501.03	548.59	574.34	521.69	379.22	254.78	267.21	392.23	451.38	436.49	433.54	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm, W = [(39)m × ((93)m – (96)m)]

(97)m=	993.84	964.56	877.2	740.8	571.6	386.16	255.49	268.55	416.94	627.7	829.24	997.38	(97)

Space heating requirement for each month, kWh/month = 0.024 × [(97)m – (95)m] × (41)m

(98)m=	402.3	311.49	244.49	119.85	37.13	0	0	0	0	131.18	282.78	419.5	(98)

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	1948.72	(98)

Space heating requirement in kWh/m²/year

27.29	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)

Fraction of space heat from community system 1 – (301) =

1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1	(303a)

Fraction of total space heat from Community boilers

(302) × (303a) =	1	(304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)

Distribution loss factor (Table 12c) for community heating system

1.05	(306)

Space heating

Annual space heating requirement

kWh/year

1948.72	(307a)

Space heat from Community boilers

(98) × (304a) × (305) × (306) =	2046.15	(307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0	(308)

DER WorkSheet: New dwelling design stage

Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)
Water heating			
Annual water heating requirement		2040.97	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	2143.01	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	41.89	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		46.22	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	46.22	(331)
Energy for lighting (calculated in Appendix L)		328.7	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		
			93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 972.97 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 21.74 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 994.71 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		994.71 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 23.99 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 170.6 (379)
Total CO2, kg/year	sum of (376)...(382) =		1189.29 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		16.65 (384)
EI rating (section 14)			86.31 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-8-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	71.03 (1a) x	2.4 (2a) =	170.47 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.03 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.47 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 2			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		
Windows Type 3			4.6	$\times 1/[1/(1.2) + 0.04]$	5.27		
Walls Type1	25.33	9.2	16.13	0.18	2.9		
Walls Type2	13.71	2.1	11.61	0.18	2.09		
Roof	10.34	0	10.34	0.11	1.14		
Total area of elements, m²			49.38				
Party wall			52.54	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 19.18 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.88 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 29.06 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13	28.13

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 57.19 57.19 57.19 57.19 57.19 57.19 57.19 57.19 57.19 57.19 57.19 57.19

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81		
Average = Sum(40) _{1...12} /12=													0.81	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.27

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

88.13

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.95	93.42	89.9	86.37	82.85	79.32	79.32	82.85	86.37	89.9	93.42	96.95		
Total = Sum(44) _{1...12} =													1057.6	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.77	125.74	129.75	113.12	108.54	93.66	86.79	99.6	100.79	117.46	128.21	139.23		
Total = Sum(45) _{1...12} =													1386.68	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.57	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.88		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

DER WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.05	175.67	185.03	166.62	163.82	147.16	142.07	154.87	154.28	172.73	181.71	194.51	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.05	175.67	185.03	166.62	163.82	147.16	142.07	154.87	154.28	172.73	181.71	194.51	
Output from water heater (annual) _{1...12}												2037.52	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	92.02	81.75	87.36	80.41	80.31	73.94	73.08	77.34	76.31	83.28	85.43	90.52	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	113.54	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.87	16.76	13.63	10.32	7.71	6.51	7.04	9.15	12.28	15.59	18.19	19.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.69	201.76	196.54	185.42	171.39	158.2	149.39	147.32	152.54	163.66	177.69	190.88	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	-90.83	(71)

Water heating gains (Table 5)

(72)m=	123.69	121.65	117.43	111.68	107.95	102.69	98.23	103.95	105.98	111.93	118.65	121.66	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	399.31	397.24	384.66	364.48	344.11	324.47	311.72	317.48	327.86	348.24	371.59	389	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)

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West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 50.09 97.98 161.36 235.34 288.41 295.24 281.08 241.45 187.67 116.26 62.45 41.19 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 449.4 495.22 546.02 599.82 632.53 619.71 592.8 558.92 515.53 464.5 434.05 430.19 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	1	0.99	0.98	0.92	0.78	0.58	0.42	0.47	0.73	0.95	0.99	1

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m= 20.28 20.39 20.58 20.81 20.95 20.99 21 21 20.98 20.78 20.49 20.25 (87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.74	0.52	0.35	0.39	0.66	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.29	19.45	19.72	20.03	20.2	20.24	20.25	20.25	20.23	20	19.58	19.24	(90)

fLA = Living area ÷ (4) =	0.4	(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.69	19.83	20.07	20.34	20.5	20.54	20.55	20.55	20.53	20.32	19.94	19.64	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.69	19.83	20.07	20.34	20.5	20.54	20.55	20.55	20.53	20.32	19.94	19.64	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.97	0.91	0.75	0.54	0.38	0.42	0.69	0.93	0.99	1	(94)

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	447.03	489.87	529.86	543.12	476.84	337.28	225.64	236.84	356.04	434.22	428.87	428.46	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm, W = [(39)m × ((93)m – (96)m)]

(97)m=	880	853.7	775.87	654.16	503.35	339.97	225.84	237.26	367.65	555.68	734.56	883.2	(97)

Space heating requirement for each month, kWh/month = 0.024 × [(97)m – (95)m] × (41)m

(98)m=	322.13	244.49	183.03	79.95	19.72	0	0	0	0	90.37	220.1	338.33	(98)

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	1498.12	(98)

Space heating requirement in kWh/m²/year

21.09	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)

Fraction of space heat from community system 1 – (301) =

1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1	(303a)

Fraction of total space heat from Community boilers

(302) × (303a) =	1	(304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)

Distribution loss factor (Table 12c) for community heating system

1.05	(306)

Space heating

Annual space heating requirement

kWh/year

1498.12	(307a)

Space heat from Community boilers

(98) × (304a) × (305) × (306) =	1573.03	(307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0	(308)

DER WorkSheet: New dwelling design stage

Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)
Water heating			
Annual water heating requirement		2037.52	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	2139.39	(310a)
Electricity used for heat distribution	$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$	37.12	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		45.96	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	45.96	(331)
Energy for lighting (calculated in Appendix L)		333.28	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		
			93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 862.24 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 19.27 (372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$		= 881.51 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		881.51 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 23.85 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 172.97 (379)
Total CO2, kg/year	sum of (376) ... (382) =		1078.33 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		15.18 (384)
El rating (section 14)			87.55 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-8-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	74.5 (1a) x	2.4 (2a) =	178.8 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	178.8 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		(26)
Windows Type 1			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		(27)
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 3			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 4			5.29	$\times 1/[1/(1.2) + 0.04]$	6.06		(27)
Windows Type 5			4.6	$\times 1/[1/(1.2) + 0.04]$	5.27		(27)
Walls Type1	39.17	17.25	21.92	0.18	3.95		(29)
Walls Type2	5.47	2.1	3.37	0.18	0.61		(29)
Roof	74.5	0	74.5	0.11	8.19		(30)
Total area of elements, m²			119.14				(31)
Party wall			51.4	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 35.02 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.23 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 47.25 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

76.75	76.75	76.75	76.75	76.75	76.75	76.75	76.75	76.75	76.75	76.75	76.75

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

76.75

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

1.03

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

2.35

(42)

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

90.02

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

99.02	95.42	91.82	88.22	84.62	81.02	81.02	84.62	88.22	91.82	95.42	99.02

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1080.22

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

146.84	128.43	132.53	115.54	110.87	95.67	88.65	101.73	102.94	119.97	130.96	142.21

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1416.34

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

22.03	19.26	19.88	17.33	16.63	14.35	13.3	15.26	15.44	18	19.64	21.33

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(56)

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

202.12	178.36	187.81	169.04	166.14	149.16	143.93	157	156.44	175.25	184.45	197.49

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

202.12	178.36	187.81	169.04	166.14	149.16	143.93	157	156.44	175.25	184.45	197.49

Output from water heater (annual) _{1...12}	2067.18

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

93.05	82.65	88.29	81.21	81.08	74.6	73.7	78.05	77.02	84.11	86.34	91.51

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

18.5	16.44	13.37	10.12	7.56	6.39	6.9	8.97	12.04	15.29	17.84	19.02

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

207.56	209.72	204.29	192.74	178.15	164.44	155.28	153.13	158.56	170.11	184.7	198.41

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01

 (71)

Water heating gains (Table 5)

(72)m=

125.06	122.98	118.67	112.8	108.98	103.62	99.06	104.9	106.98	113.05	119.91	122.99

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

409.39	407.39	394.58	373.9	352.95	332.7	319.49	325.25	335.83	356.7	380.71	398.67

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)

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West	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	73.82	143.33	238.41	359.1	455.14	473.73	447.72	373.65	280.31	170.24	91.72	60.97	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	483.2	550.72	632.99	733.01	808.09	806.42	767.21	698.9	616.14	526.94	472.43	459.64	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.79	0.59	0.44	0.5	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.11	20.37	20.68	20.9	20.98	21	20.99	20.93	20.63	20.23	19.93	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.73	0.51	0.35	0.4	0.7	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.68	18.89	19.26	19.69	19.97	20.05	20.06	20.06	20.01	19.63	19.06	18.63	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.2	19.38	19.7	20.09	20.34	20.42	20.43	20.43	20.38	20.03	19.53	19.15	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

DER WorkSheet: New dwelling design stage

(93)m=	19.2	19.38	19.7	20.09	20.34	20.42	20.43	20.43	20.38	20.03	19.53	19.15	(93)

8. Space heating requirement

Set $T_{i,m}$ to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, h_m :

(94)m=	0.99	0.99	0.97	0.9	0.75	0.54	0.38	0.44	0.73	0.95	0.99	1	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	480.73	544.79	614.18	662.94	607.67	438.89	293.27	307.45	447.72	498.2	467.36	457.83	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	1143.44	1111.41	1013.15	858.59	663.24	446.83	294.21	309.43	481.84	723.57	954.09	1147.22	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	493.05	380.77	296.83	140.87	41.35	0	0	0	0	167.68	350.45	512.91	

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 2383.9 (98)

Space heating requirement in $kWh/m^2/year$

32 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2383.9

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 2503.09 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2067.18

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2170.54 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 46.74 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

48.21 (330a)

DER WorkSheet: New dwelling design stage

warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	48.21	(331)
Energy for lighting (calculated in Appendix L)		326.8	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1085.49 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 24.26 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1109.74 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1109.74 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 25.02 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 169.61 (379)
Total CO2, kg/year	sum of (376)...(382) =		1304.37 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		17.51 (384)
EI rating (section 14)			85.37 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-9-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	53.68 (1a)	2.4 (2a)	128.83 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.68 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	128.83 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 2			4.6	$\times 1/[1/(1.2) + 0.04]$	5.27		
Windows Type 3			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 4			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Walls Type1	35.36	12.88	22.48	0.18	4.05		
Walls Type2	35.36	2.1	33.26	0.18	5.99		
Roof	17.33	0	17.33	0.11	1.91		
Total area of elements, m²			88.05				

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 29.21 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.46 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 39.67 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	21.26	21.26	21.26	21.26	21.26	21.26	21.26	21.26	21.26	21.26	21.26	21.26

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 60.93 60.93 60.93 60.93 60.93 60.93 60.93 60.93 60.93 60.93 60.93 60.93 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13		
Average = Sum(40) _{1...12} /12=													1.13	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

1.8

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

76.92

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	84.61	81.53	78.45	75.38	72.3	69.22	69.22	72.3	75.38	78.45	81.53	84.61		
Total = Sum(44) _{1...12} =													923	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	125.47	109.74	113.24	98.73	94.73	81.74	75.75	86.92	87.96	102.51	111.9	121.51		
Total = Sum(45) _{1...12} =													1210.2	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.82	16.46	16.99	14.81	14.21	12.26	11.36	13.04	13.19	15.38	16.78	18.23		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

180.75	159.67	168.52	152.22	150.01	135.24	131.02	142.2	141.45	157.79	165.39	176.79

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

180.75	159.67	168.52	152.22	150.01	135.24	131.02	142.2	141.45	157.79	165.39	176.79

Output from water heater (annual)_{1...12}

1861.04

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

85.94	76.43	81.87	75.62	75.72	69.97	69.41	73.12	72.04	78.31	80	84.62

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93	89.93

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

13.98	12.41	10.1	7.64	5.71	4.82	5.21	6.77	9.09	11.55	13.48	14.37

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

156.78	158.4	154.3	145.58	134.56	124.21	117.29	115.66	119.76	128.49	139.51	149.86

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99	31.99

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94	-71.94

 (71)

Water heating gains (Table 5)

(72)m=

115.51	113.73	110.05	105.03	101.77	97.19	93.29	98.28	100.06	105.25	111.11	113.74

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

336.24	334.53	324.42	308.23	292.03	276.2	265.77	270.7	278.89	295.26	314.07	327.95

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)							
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.76</td></tr></table>	2.76	x	<table><tr><td>10.63</td></tr></table>	10.63	x	<table><tr><td>0.5</td></tr></table>	0.5	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>8.14</td></tr></table>	8.14	(74)
0.77																			
2.76																			
10.63																			
0.5																			
0.8																			
8.14																			
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.76</td></tr></table>	2.76	x	<table><tr><td>10.63</td></tr></table>	10.63	x	<table><tr><td>0.5</td></tr></table>	0.5	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>8.14</td></tr></table>	8.14	(74)
0.77																			
2.76																			
10.63																			
0.5																			
0.8																			
8.14																			
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.76</td></tr></table>	2.76	x	<table><tr><td>20.32</td></tr></table>	20.32	x	<table><tr><td>0.5</td></tr></table>	0.5	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>15.55</td></tr></table>	15.55	(74)
0.77																			
2.76																			
20.32																			
0.5																			
0.8																			
15.55																			
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.76</td></tr></table>	2.76	x	<table><tr><td>20.32</td></tr></table>	20.32	x	<table><tr><td>0.5</td></tr></table>	0.5	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>15.55</td></tr></table>	15.55	(74)
0.77																			
2.76																			
20.32																			
0.5																			
0.8																			
15.55																			
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.76</td></tr></table>	2.76	x	<table><tr><td>34.53</td></tr></table>	34.53	x	<table><tr><td>0.5</td></tr></table>	0.5	x	<table><tr><td>0.8</td></tr></table>	0.8	=	<table><tr><td>26.42</td></tr></table>	26.42	(74)
0.77																			
2.76																			
34.53																			
0.5																			
0.8																			
26.42																			

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)

DER WorkSheet: New dwelling design stage

East $0.9 \times \boxed{0.77} \times \boxed{2.76} \times \boxed{16.15} \times \boxed{0.5} \times \boxed{0.8} = \boxed{12.36}$ (76)

East $0.9 \times \boxed{0.77} \times \boxed{4.6} \times \boxed{16.15} \times \boxed{0.5} \times \boxed{0.8} = \boxed{20.59}$ (76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=

56.34	109.48	181.93	273.14	345.06	358.58	339.13	283.81	213.66	130.02	70.03	46.52

 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=

392.59	444.01	506.35	581.37	637.08	634.78	604.9	554.51	492.55	425.29	384.11	374.46

 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.99	0.97	0.92	0.78	0.59	0.44	0.5	0.76	0.95	0.99	1

 (86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=

19.9	20.05	20.32	20.64	20.88	20.98	21	20.99	20.92	20.6	20.18	19.86

 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=

19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97

 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=

0.99	0.99	0.97	0.89	0.72	0.51	0.34	0.39	0.68	0.93	0.99	0.99

 (89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=

18.52	18.74	19.12	19.57	19.86	19.96	19.97	19.97	19.91	19.52	18.93	18.46

 (90)

fLA = Living area ÷ (4) =

0.5

 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=

19.21	19.39	19.72	20.11	20.37	20.47	20.48	20.48	20.42	20.06	19.56	19.16

 (92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=

19.21	19.39	19.72	20.11	20.37	20.47	20.48	20.48	20.42	20.06	19.56	19.16

 (93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=

0.99	0.98	0.96	0.89	0.75	0.55	0.39	0.44	0.72	0.93	0.98	0.99

 (94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=

389.42	437.19	487.41	520.18	477.06	348.75	235.37	246.28	353.97	397.04	378.04	372.04

 (95)

Monthly average external temperature from Table 8

(96)m=

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2

 (96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=

908.45	883.1	805.27	682.74	528.38	357.47	236.6	248.63	384.94	576.42	758.89	911.43

 (97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=

386.16	299.65	236.49	117.04	38.18	0	0	0	0	133.46	274.22	401.3

 (98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

1886.49

 (98)

Space heating requirement in kWh/m²/year

35.14

 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)
<i>The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.</i>			
Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		kWh/year	
Annual space heating requirement		1886.49	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1980.82	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1861.04	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1954.09	(310a)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	39.35	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		34.74	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	34.74	(331)
Energy for lighting (calculated in Appendix L)		246.84	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	= 913.91 (367)
Electrical energy for heat distribution	[(313) x	0.52	= 20.42 (372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)		= 934.34 (373)
CO2 associated with space heating (secondary)	(309) x	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	= 0 (375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		934.34 (376)
CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	= 18.03 (378)

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CO2 associated with electricity for lighting	(332))) x	0.52	=	128.11	(379)
Total CO2, kg/year	sum of (376)...(382) =			1080.47	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			20.13	(384)
El rating (section 14)				85.33	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-9-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	50.65 (1a) x	2.4 (2a) =	121.56 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.65 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.56 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.2	= 2.52		(26)
Windows Type 1			4.6	x 1/[1/(1.2)+0.04]	= 5.27		(27)
Windows Type 2			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 3			1.84	x 1/[1/(1.2)+0.04]	= 2.11		(27)
Windows Type 4			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Walls Type1	36.62	11.96	24.66	x 0.18	= 4.44		(29)
Walls Type2	25.07	2.1	22.97	x 0.18	= 4.13		(29)
Roof	21.11	0	21.11	x 0.11	= 2.32		(30)
Total area of elements, m²			82.8				(31)
Party wall			14.75	x 0	= 0		(32)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 27.11 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.58 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.69 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=

20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

57.75	57.75	57.75	57.75	57.75	57.75	57.75	57.75	57.75	57.75	57.75	57.75

Average = Sum(39)_{1...12} / 12 =

57.75 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14

Average = Sum(40)_{1...12} / 12 =

1.14 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA - 13.9)²)] + 0.0013 × (TFA - 13.9)

if TFA ≤ 13.9, N = 1

1.71 (42)

Annual average hot water usage in litres per day Vd,average = (25 × N) + 36

74.79 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c × (43)

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
82.27	79.28	76.29	73.3	70.31	67.32	67.32	70.31	73.3	76.29	79.28	82.27

Total = Sum(44)_{1...12} =

897.54 (44)

Energy content of hot water used - calculated monthly = 4.190 × Vd,m × nm × DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

122.01	106.71	110.12	96	92.12	79.49	73.66	84.52	85.53	99.68	108.81	118.16

Total = Sum(45)_{1...12} =

1176.81 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

18.3	16.01	16.52	14.4	13.82	11.92	11.05	12.68	12.83	14.95	16.32	17.72

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) × (49) =

110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03 (52)

Temperature factor from Table 2b

0.6 (53)

Energy lost from water storage, kWh/year

(47) × (51) × (52) × (53) =

1.03 (54)

Enter (50) or (54) in (55)

1.03 (55)

Water storage loss calculated for each month

((56)m = (55) × (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	177.29	156.64	165.39	149.5	147.39	132.98	128.94	139.8	139.03	154.96	162.3	173.44

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=	177.29	156.64	165.39	149.5	147.39	132.98	128.94	139.8	139.03	154.96	162.3	173.44

Output from water heater (annual)_{1...12}

1827.65

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.79	75.42	80.84	74.72	74.85	69.23	68.71	72.33	71.23	77.37	78.97	83.51

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46	85.46

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.28	11.79	9.59	7.26	5.43	4.58	4.95	6.44	8.64	10.97	12.8	13.65

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.92	150.47	146.57	138.28	127.82	117.98	111.41	109.87	113.76	122.05	132.52	142.35

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55

(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37	-68.37

(71)

Water heating gains (Table 5)

(72)m=	113.96	112.24	108.65	103.77	100.6	96.15	92.36	97.21	98.94	103.99	109.69	112.24

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	324.8	323.14	313.45	297.95	282.49	267.35	257.36	262.15	269.97	285.64	303.64	316.88

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (76)

(76)

(76)

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East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	113.51	195.48	270.93	337.99	378.11	374.49	361.47	332.12	294.49	217.19	136.4	96.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	438.31	518.61	584.38	635.94	660.6	641.84	618.83	594.27	564.46	502.83	440.04	413.71	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.87	0.74	0.56	0.41	0.44	0.67	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.01	20.21	20.47	20.73	20.91	20.98	21	21	20.96	20.72	20.31	19.96	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.84	0.68	0.48	0.31	0.35	0.58	0.86	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.68	18.97	19.33	19.68	19.89	19.96	19.97	19.97	19.94	19.68	19.11	18.6	(90)

fLA = Living area ÷ (4) =

0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.59	19.9	20.2	20.4	20.47	20.48	20.48	20.45	20.2	19.71	19.28	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.59	19.9	20.2	20.4	20.47	20.48	20.48	20.45	20.2	19.71	19.28	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.98	0.97	0.93	0.85	0.7	0.52	0.36	0.39	0.62	0.87	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	431.4	501.02	542.13	537.85	465.16	332.51	223.36	234.36	351.01	438.96	425.75	408.64	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	869.09	848.42	773.85	652.86	502.32	338.96	224.2	235.68	366.62	554.5	728.13	871.05	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	325.64	233.45	172.4	82.81	27.65	0	0	0	0	85.96	217.71	344.03	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1489.65 (99)

Space heating requirement in kWh/m²/year

29.41 (99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

1489.65

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

1564.13 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

1827.65

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

1919.03 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

34.83 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

32.78 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

32.78 (331)

Energy for lighting (calculated in Appendix L)

234.47 (332)

12b. CO2 Emissions – Community heating scheme

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%)

If there is CHP using two fuels repeat (363) to (366) for the second fuel

93 (367a)

CO2 associated with heat source 1

[(307b)+(310b)] x 100 ÷ (367b) x

0.22

= 808.99 (367)

Electrical energy for heat distribution

[(313) x

0.52

= 18.08 (372)

Total CO2 associated with community systems

(363)...(366) + (368)...(372)

= 827.07 (373)

CO2 associated with space heating (secondary)

(309) x

0

= 0 (374)

CO2 associated with water from immersion heater or instantaneous heater

(312) x

0.22

= 0 (375)

Total CO2 associated with space and water heating

(373) + (374) + (375) =

827.07 (376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	17.01	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	121.69	(379)
Total CO2, kg/year	sum of (376)...(382) =			965.77	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			19.07	(384)
El rating (section 14)				86.47	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-9-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	101.62 (1a)	2.4 (2a)	243.89 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	101.62 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	243.89 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)					0 (9)
Additional infiltration					0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction					0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0					0 (12)
If no draught lobby, enter 0.05, else enter 0					0 (13)
Percentage of windows and doors draught stripped					0 (14)
Window infiltration				0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate				(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area					4 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)					0.2 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor				(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.2	= 2.52		(26)
Windows Type 1			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 2			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 3			5.29	x 1/[1/(1.2)+0.04]	= 6.06		(27)
Windows Type 4			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 5			5.29	x 1/[1/(1.2)+0.04]	= 6.06		(27)
Walls Type1	49.24	18.86	30.38	x 0.18	= 5.47		(29)
Walls Type2	14.73	2.1	12.63	x 0.18	= 2.27		(29)
Roof	31.96	0	31.96	x 0.11	= 3.52		(30)
Total area of elements, m²			95.93				(31)
Party wall			34.51	x 0	= 0		(32)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 35.37 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.54 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 47.91 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
40.24	40.24	40.24	40.24	40.24	40.24	40.24	40.24	40.24	40.24	40.24	40.24

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

88.15	88.15	88.15	88.15	88.15	88.15	88.15	88.15	88.15	88.15	88.15	88.15

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

88.15

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

0.87

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.75

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

99.61

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

109.57	105.58	101.6	97.62	93.63	89.65	89.65	93.63	97.62	101.6	105.58	109.57

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1195.3

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

162.49	142.11	146.65	127.85	122.68	105.86	98.09	112.57	113.91	132.75	144.91	157.36

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1567.22

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

24.37	21.32	22	19.18	18.4	15.88	14.71	16.88	17.09	19.91	21.74	23.6

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

217.76	192.04	201.92	181.34	177.95	159.35	153.37	167.84	167.4	188.03	198.4	212.64

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

217.76	192.04	201.92	181.34	177.95	159.35	153.37	167.84	167.4	188.03	198.4	212.64

Output from water heater (annual) ^{1...12}	2218.06

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

98.25	87.19	92.98	85.31	85.01	77.99	76.84	81.65	80.67	88.36	90.98	96.54

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7	137.7

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

23.13	20.54	16.71	12.65	9.46	7.98	8.63	11.21	15.05	19.11	22.3	23.77

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

258.92	261.61	254.84	240.42	222.23	205.13	193.7	191.02	197.79	212.2	230.4	247.5

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77	36.77

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16	-110.16

 (71)

Water heating gains (Table 5)

(72)m=

132.05	129.75	124.98	118.48	114.26	108.32	103.28	109.74	112.04	118.76	126.36	129.76

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

478.42	476.22	460.83	435.86	410.26	385.74	369.92	376.28	389.19	414.38	443.36	465.34

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	5.29	x	46.75	x	0.5	x	0.8	=	68.56	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	5.29	x	76.57	x	0.5	x	0.8	=	112.28	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	5.29	x	97.53	x	0.5	x	0.8	=	143.02	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	5.29	x	110.23	x	0.5	x	0.8	=	161.65	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	5.29	x	114.87	x	0.5	x	0.8	=	168.45	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	5.29	x	110.55	x	0.5	x	0.8	=	162.11	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	5.29	x	108.01	x	0.5	x	0.8	=	158.39	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	5.29	x	104.89	x	0.5	x	0.8	=	153.82	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	5.29	x	101.89	x	0.5	x	0.8	=	149.4	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	5.29	x	82.59	x	0.5	x	0.8	=	121.1	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	5.29	x	55.42	x	0.5	x	0.8	=	81.26	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	5.29	x	40.4	x	0.5	x	0.8	=	59.24	(78)
West	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(80)

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West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	183.92	315.17	433.45	536.24	596.58	589.6	569.61	525.59	469.52	349.2	220.71	157.09	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	662.34	791.39	894.29	972.1	1006.83	975.34	939.52	901.87	858.7	763.58	664.07	622.44	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.76	0.57	0.41	0.45	0.68	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.38	20.6	20.81	20.95	20.99	21	21	20.98	20.8	20.45	20.16	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.87	0.71	0.5	0.34	0.37	0.61	0.9	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.14	19.38	19.69	19.99	20.15	20.19	20.19	20.19	20.18	19.97	19.48	19.07	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.46	19.68	19.96	20.23	20.39	20.43	20.44	20.44	20.42	20.22	19.77	19.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.46	19.68	19.96	20.23	20.39	20.43	20.44	20.44	20.42	20.22	19.77	19.4	(93)

8. Space heating requirement

Set $T_{i,m}$ to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, h_m :

(94)m=	0.99	0.98	0.95	0.88	0.72	0.52	0.36	0.39	0.63	0.9	0.98	1	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	658.4	777.86	852.36	850.86	728.47	509.81	337.84	355.18	543.94	690.73	653.87	619.84	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	1336.25	1303.16	1186.91	999.19	765.88	514.04	338.18	355.78	557.11	848.07	1117.12	1339.64	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	504.32	353	248.9	106.8	27.83	0	0	0	0	117.06	333.54	535.53	

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 2226.99 (98)

Space heating requirement in $kWh/m^2/year$

21.91 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2226.99

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 2338.34 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2218.06

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2328.97 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 46.67 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

65.76 (330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	65.76	(331)
Energy for lighting (calculated in Appendix L)		408.5	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1084.02 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 24.22 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1108.24 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1108.24 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 34.13 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 212.01 (379)
Total CO2, kg/year	sum of (376)...(382) =		1354.38 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		13.33 (384)
EI rating (section 14)			87.62 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b1-9-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	104.77 (1a)	2.4 (2a)	251.45 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	104.77 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	251.45 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	0.85 (20)

Infiltration rate incorporating shelter factor	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.2	= 2.52		(26)
Windows Type 1			1.84	x 1/[1/(1.2) + 0.04]	= 2.11		(27)
Windows Type 2			2.76	x 1/[1/(1.2) + 0.04]	= 3.16		(27)
Windows Type 3			1.84	x 1/[1/(1.2) + 0.04]	= 2.11		(27)
Windows Type 4			1.84	x 1/[1/(1.2) + 0.04]	= 2.11		(27)
Windows Type 5			1.84	x 1/[1/(1.2) + 0.04]	= 2.11		(27)
Windows Type 6			9.06	x 1/[1/(1.2) + 0.04]	= 10.37		(27)
Windows Type 7			2.76	x 1/[1/(1.2) + 0.04]	= 3.16		(27)
Walls Type1	50.36	21.94	28.42	x 0.18	= 5.12		(29)
Walls Type2	31.52	2.1	29.42	x 0.18	= 5.3		(29)
Roof	28.91	0	28.91	x 0.11	= 3.18		(30)
Total area of elements, m²			110.79				(31)
Party wall			18.84	x 0	= 0		(32)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 41.23 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.02 (36)

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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 56.25 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.49	41.49	41.49	41.49	41.49	41.49	41.49	41.49	41.49	41.49	41.49	41.49	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	97.74	97.74	97.74	97.74	97.74	97.74	97.74	97.74	97.74	97.74	97.74	97.74	(39)
Average = Sum(39) _{1...12} / 12 =												97.74	(40)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	(40)
Average = Sum(40) _{1...12} / 12 =												0.93	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.78 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 100.21 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	110.23	106.23	102.22	98.21	94.2	90.19	90.19	94.2	98.21	102.22	106.23	110.23	(44)
Total = Sum(44) _{1...12} =												1202.56	(45)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	163.47	142.98	147.54	128.63	123.42	106.5	98.69	113.25	114.6	133.56	145.79	158.32	(45)
Total = Sum(45) _{1...12} =												1576.75	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	24.52	21.45	22.13	19.29	18.51	15.98	14.8	16.99	17.19	20.03	21.87	23.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

218.75	192.9	202.82	182.12	178.7	160	153.97	168.53	168.1	188.83	199.28	213.59

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

218.75	192.9	202.82	182.12	178.7	160	153.97	168.53	168.1	188.83	199.28	213.59

 Output from water heater (annual)_{1, 12} 2227.59 (64)

Heat gains from water heating, kWh/month 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

(65)m=

98.58	87.48	93.28	85.56	85.26	78.21	77.04	81.88	80.9	88.63	91.27	96.86

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98	138.98

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

23.52	20.89	16.99	12.86	9.61	8.12	8.77	11.4	15.3	19.43	22.68	24.17

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

263.82	266.55	259.66	244.97	226.43	209.01	197.37	194.63	201.53	216.21	234.75	252.18

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18	-111.18

 (71)

Water heating gains (Table 5)

(72)m=

132.5	130.18	125.37	118.84	114.6	108.62	103.54	110.05	112.36	119.13	126.76	130.19

 (72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=

484.52	482.32	466.71	441.36	415.33	390.44	374.37	380.77	393.88	419.46	448.88	471.23

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d			Area m ²	Flux Table 6a			g_ Table 6b	FF Table 6c			Gains (W)	
North	0.9x	0.77	x	9.06	x	10.63	x	0.5	x	0.8	=	26.71	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	9.06	x	20.32	x	0.5	x	0.8	=	51.03	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	9.06	x	34.53	x	0.5	x	0.8	=	86.72	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	9.06	x	55.46	x	0.5	x	0.8	=	139.3	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	9.06	x	74.72	x	0.5	x	0.8	=	187.64	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	9.06	x	79.99	x	0.5	x	0.8	=	200.88	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	9.06	x	74.68	x	0.5	x	0.8	=	187.55	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	9.06	x	59.25	x	0.5	x	0.8	=	148.79	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	9.06	x	41.52	x	0.5	x	0.8	=	104.27	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	9.06	x	24.19	x	0.5	x	0.8	=	60.75	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	9.06	x	13.12	x	0.5	x	0.8	=	32.94	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	9.06	x	8.86	x	0.5	x	0.8	=	22.26	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	89.94	174.36	290.64	440.6	562.06	586.84	553.87	459.71	342.47	207.15	111.68	74.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	574.46	656.68	757.35	881.96	977.39	977.28	928.24	840.48	736.35	626.61	560.56	545.59	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.82	0.62	0.46	0.53	0.82	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.01	20.14	20.38	20.68	20.9	20.98	21	21	20.93	20.62	20.25	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.14	20.14	20.14	20.14	20.14	20.14	20.14	20.14	20.14	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.98	0.93	0.77	0.55	0.37	0.43	0.75	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.81	19	19.34	19.76	20.05	20.13	20.14	20.14	20.09	19.69	19.16	18.75	(90)

fLA = Living area ÷ (4) =

0.3

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.17	19.34	19.65	20.04	20.3	20.39	20.4	20.39	20.34	19.97	19.49	19.12	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.17	19.34	19.65	20.04	20.3	20.39	20.4	20.39	20.34	19.97	19.49	19.12	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.93	0.78	0.57	0.4	0.46	0.76	0.96	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	573.09	653	743.72	819.88	767.14	556.19	370.12	388.28	563.22	604.46	557.5	544.61	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1453.23	1411.41	1285.12	1088.45	840.93	565.53	371.06	390.46	609.79	916.04	1210.82	1458.37	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	654.83	509.66	402.81	193.37	54.9	0	0	0	0	231.82	470.39	679.83	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

3197.6

(98)

Space heating requirement in kWh/m²/year

30.52

(99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

3197.6

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

3357.48 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2227.59

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2338.97 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

56.96 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

67.8 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

67.8 (331)

Energy for lighting (calculated in Appendix L)

415.36 (332)

12b. CO2 Emissions – Community heating scheme

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%)

If there is CHP using two fuels repeat (363) to (366) for the second fuel

93 (367a)

CO2 associated with heat source 1

[(307b)+(310b)] x 100 ÷ (367b) x

0.22

= 1323.05 (367)

Electrical energy for heat distribution

[(313) x

0.52

= 29.56 (372)

Total CO2 associated with community systems

(363)...(366) + (368)...(372)

= 1352.61 (373)

CO2 associated with space heating (secondary)

(309) x

0

= 0 (374)

CO2 associated with water from immersion heater or instantaneous heater

(312) x

0.22

= 0 (375)

Total CO2 associated with space and water heating

(373) + (374) + (375) =

1352.61 (376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	=	35.19	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	215.57	(379)
Total CO2, kg/year	sum of (376)...(382) =			1603.37	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.3	(384)
El rating (section 14)				85.65	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-10-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	74.09 (1a) x	2.4 (2a) =	177.82 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.09 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	177.82 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 2			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 3			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 4			4.6	$\times 1/[1/(1.2)+0.04]$	5.27		
Walls Type1	31	12.88	18.12	0.18	3.26		
Walls Type2	31.26	2.1	29.16	0.18	5.25		
Roof	19.99	0	19.99	0.11	2.2		
Total area of elements, m²			82.25				
Party wall			31.88	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 27.98 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.76 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 40.74 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=

29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

70.08	70.08	70.08	70.08	70.08	70.08	70.08	70.08	70.08	70.08	70.08	70.08

Average = Sum(39)_{1...12} /12=

70.08

 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95

Average = Sum(40)_{1...12} /12=

0.95

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

2.34

 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

89.8

 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
98.78	95.19	91.6	88.01	84.42	80.82	80.82	84.42	88.01	91.6	95.19	98.78

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)
(44)m=

98.78	95.19	91.6	88.01	84.42	80.82	80.82	84.42	88.01	91.6	95.19	98.78

Total = Sum(44)_{1...12} =

1077.64

 (44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)
(45)m=

146.49	128.12	132.21	115.27	110.6	95.44	88.44	101.49	102.7	119.68	130.64	141.87

Total = Sum(45)_{1...12} =

1412.96

 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

21.97	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.4	17.95	19.6	21.28

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

 (48)

Temperature factor from Table 2b

0

 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110

 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

 (52)

Temperature factor from Table 2b

0.6

 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03

 (54)

Enter (50) or (54) in (55)

1.03

 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

201.77	178.05	187.49	168.76	165.88	148.93	143.72	156.76	156.19	174.96	184.14	197.15

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=

201.77	178.05	187.49	168.76	165.88	148.93	143.72	156.76	156.19	174.96	184.14	197.15

Output from water heater (annual)_{1...12}

2063.8

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=

92.93	82.54	88.18	81.12	81	74.53	73.63	77.97	76.94	84.02	86.23	91.39

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

18.57	16.49	13.41	10.15	7.59	6.41	6.92	9	12.08	15.34	17.9	19.08

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

206.65	208.79	203.39	191.89	177.36	163.72	154.6	152.45	157.86	169.36	183.88	197.53

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71

(69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65

(71)

Water heating gains (Table 5)

(72)m=

124.91	122.83	118.52	112.67	108.87	103.51	98.96	104.79	106.86	112.93	119.77	122.84

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

408.24	406.23	393.44	372.82	351.94	331.75	318.6	324.36	334.92	355.74	379.67	397.57

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
North	0.9x	0.77	x	4.6	x	10.63	x	0.5	x	0.8	=	13.56	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.5	x	0.8	=	25.91	(74)

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North	0.9x	0.77	x	4.6	x	34.53	x	0.5	x	0.8	=	44.03	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.5	x	0.8	=	70.72	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.5	x	0.8	=	95.27	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.5	x	0.8	=	101.99	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.5	x	0.8	=	95.22	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.5	x	0.8	=	75.55	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.5	x	0.8	=	52.94	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.5	x	0.8	=	30.84	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.5	x	0.8	=	16.73	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.5	x	0.8	=	11.3	(74)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)

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East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	58.64	114.1	189.26	282.53	354.84	367.71	348.2	292.85	221.84	135.48	72.93	48.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	466.88	520.33	582.7	655.35	706.78	699.46	666.8	617.21	556.76	491.22	452.6	445.95	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.82	0.62	0.46	0.52	0.79	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.07	20.2	20.42	20.69	20.9	20.98	21	21	20.94	20.67	20.31	20.04	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.77	0.55	0.37	0.42	0.72	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.89	19.07	19.39	19.77	20.04	20.12	20.13	20.13	20.08	19.74	19.23	18.83	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.36	19.52	19.8	20.14	20.38	20.46	20.48	20.47	20.43	20.11	19.66	19.31	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.36	19.52	19.8	20.14	20.38	20.46	20.48	20.47	20.43	20.11	19.66	19.31	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.92	0.78	0.58	0.41	0.46	0.74	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	464.74	515.56	568.43	603.59	554.16	403.42	270.81	283.9	413.59	466.88	448.21	444.37	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1055.5	1024.47	931.97	787.91	608.56	411	271.62	285.54	443.37	666.55	880.52	1059.26	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	439.52	341.99	270.47	132.71	40.48	0	0	0	0	148.56	311.27	457.48	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2142.48 (99)

Space heating requirement in kWh/m²/year

28.92 (99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

kWh/year

Annual space heating requirement

2142.48

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

2249.6 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2063.8

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2166.99 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

44.17 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

47.94 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

47.94 (331)

Energy for lighting (calculated in Appendix L)

327.88 (332)

12b. CO2 Emissions – Community heating scheme

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%)

If there is CHP using two fuels repeat (363) to (366) for the second fuel

93 (367a)

CO2 associated with heat source 1

[(307b)+(310b)] x 100 ÷ (367b) x

0.22

=

1025.79 (367)

Electrical energy for heat distribution

[(313) x

0.52

=

22.92 (372)

Total CO2 associated with community systems

(363)...(366) + (368)...(372)

=

1048.71 (373)

CO2 associated with space heating (secondary)

(309) x

0

=

0 (374)

CO2 associated with water from immersion heater or instantaneous heater

(312) x

0.22

=

0 (375)

Total CO2 associated with space and water heating

(373) + (374) + (375) =

1048.71 (376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	=	24.88	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	170.17	(379)
Total CO2, kg/year	sum of (376)...(382) =			1243.76	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.79	(384)
El rating (section 14)				86.01	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-10-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	75.18 (1a) x	2.4 (2a) =	180.43 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.18 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	180.43 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 2			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 3			5.29	$\times 1/[1/(1.2)+0.04]$	6.06		
Windows Type 4			4.6	$\times 1/[1/(1.2)+0.04]$	5.27		
Walls Type1	41.41	15.41	26	0.18	4.68		
Walls Type2	4.86	2.1	2.76	0.18	0.5		
Roof	75.18	0	75.18	0.11	8.27		
Total area of elements, m²			121.45				
Party wall			42	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 33.61 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 13.72 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 47.34 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=

29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

77.11	77.11	77.11	77.11	77.11	77.11	77.11	77.11	77.11	77.11	77.11	77.11

Average = Sum(39)_{1...12} /12=

77.11

 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03

Average = Sum(40)_{1...12} /12=

1.03

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

2.37

 (42)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

90.37

 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)											

(44)m=

99.41	95.79	92.18	88.56	84.95	81.33	81.33	84.95	88.56	92.18	95.79	99.41

Total = Sum(44)_{1...12} =

1084.44

 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

147.42	128.93	133.05	115.99	111.3	96.04	89	102.13	103.35	120.44	131.47	142.77

Total = Sum(45)_{1...12} =

1421.87

 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

22.11	19.34	19.96	17.4	16.69	14.41	13.35	15.32	15.5	18.07	19.72	21.41

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

 (48)

Temperature factor from Table 2b

0

 (49)

Energy lost from water storage, kWh/year (48) x (49) =

110

 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

 (52)

Temperature factor from Table 2b

0.6

 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) =

1.03

 (54)

Enter (50) or (54) in (55)

1.03

 (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

202.69	178.86	188.32	169.49	166.58	149.54	144.27	157.4	156.84	175.72	184.96	198.04

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=

202.69	178.86	188.32	169.49	166.58	149.54	144.27	157.4	156.84	175.72	184.96	198.04

Output from water heater (annual)_{1...12}

2072.71

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=

93.24	82.81	88.46	81.36	81.23	74.73	73.81	78.18	77.16	84.27	86.51	91.69

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

18.64	16.56	13.46	10.19	7.62	6.43	6.95	9.03	12.13	15.4	17.97	19.16

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

209.07	211.24	205.78	194.14	179.44	165.64	156.41	154.24	159.71	171.35	186.04	199.85

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83

(69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6

(71)

Water heating gains (Table 5)

(72)m=

125.32	123.23	118.9	113	109.18	103.79	99.21	105.08	107.16	113.26	120.15	123.24

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

411.51	409.51	396.61	375.81	354.72	334.33	321.05	326.83	337.47	358.48	382.64	400.72

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
East	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(76)
East	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(76)

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East	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(76)
East	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(76)
East	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(76)
East	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(76)
East	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(76)
East	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(76)
East	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(76)
East	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(76)
East	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(76)
East	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	159.95	271.13	366.39	444.56	488.08	479.88	464.62	433.09	393.73	298.53	191.37	137.01	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	571.46	680.64	763	820.36	842.8	814.22	785.67	759.92	731.2	657.01	574.01	537.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.77	0.59	0.43	0.46	0.69	0.92	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.08	20.27	20.51	20.75	20.91	20.98	21	21	20.96	20.75	20.35	20.03	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.87	0.72	0.51	0.34	0.37	0.61	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.85	19.12	19.45	19.78	19.98	20.05	20.06	20.06	20.04	19.79	19.24	18.77	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.34	19.58	19.87	20.17	20.36	20.42	20.44	20.43	20.41	20.17	19.69	19.28	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.34	19.58	19.87	20.17	20.36	20.42	20.44	20.43	20.41	20.17	19.69	19.28	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.94	0.87	0.73	0.54	0.38	0.41	0.64	0.89	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	565.55	663.59	719.16	713.44	618.31	441.38	294.92	309.78	467.83	585.47	560.61	533.59	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1159.74	1131.89	1031.31	868.77	667.42	449.12	295.76	311.12	486.31	737.96	970.56	1162.41	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	442.08	314.7	232.24	111.84	36.54	0	0	0	0	113.45	295.16	467.84	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2013.85 (99)

Space heating requirement in kWh/m²/year

26.79 (99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

kWh/year

Annual space heating requirement

2013.85

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

2114.54 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2072.71

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2176.35 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

42.91 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

48.65 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

48.65 (331)

Energy for lighting (calculated in Appendix L)

329.17 (332)

12b. CO2 Emissions – Community heating scheme

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%)

If there is CHP using two fuels repeat (363) to (366) for the second fuel

93 (367a)

CO2 associated with heat source 1

[(307b)+(310b)] x 100 ÷ (367b) x

0.22

=

996.59 (367)

Electrical energy for heat distribution

[(313) x

0.52

=

22.27 (372)

Total CO2 associated with community systems

(363)...(366) + (368)...(372)

=

1018.86 (373)

CO2 associated with space heating (secondary)

(309) x

0

=

0 (374)

CO2 associated with water from immersion heater or instantaneous heater

(312) x

0.22

=

0 (375)

Total CO2 associated with space and water heating

(373) + (374) + (375) =

1018.86 (376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	=	25.25	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	170.84	(379)
Total CO2, kg/year	sum of (376)...(382) =			1214.95	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.16	(384)
El rating (section 14)				86.45	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-10-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	66.83 (1a)	2.4 (2a)	160.39 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	66.83 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	160.39 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			6.9	$\times 1/[1/(1.2)+0.04]$	7.9		
Windows Type 2			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 3			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 4			1.84	$\times 1/[1/(1.2)+0.04]$	2.11		
Walls Type1	37.48	14.26	23.22	0.18	4.18		
Walls Type2	25.22	2.1	23.12	0.18	4.16		
Roof	66.83	0	66.83	0.11	7.35		
Total area of elements, m²			129.53				
Party wall			19.67	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 34.54 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.39 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.93 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=

26.46	26.46	26.46	26.46	26.46	26.46	26.46	26.46	26.46	26.46	26.46	26.46

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

73.4	73.4	73.4	73.4	73.4	73.4	73.4	73.4	73.4	73.4	73.4	73.4

Average = Sum(39)_{1...12} /12=

73.4 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1

Average = Sum(40)_{1...12} /12=

1.1 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

2.17 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

85.66 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

94.23	90.8	87.37	83.95	80.52	77.09	77.09	80.52	83.95	87.37	90.8	94.23

Total = Sum(44)_{1...12} =

1027.93 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

139.74	122.21	126.11	109.95	105.5	91.04	84.36	96.8	97.96	114.16	124.62	135.33

Total = Sum(45)_{1...12} =

1347.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

20.96	18.33	18.92	16.49	15.82	13.66	12.65	14.52	14.69	17.12	18.69	20.3

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03 (52)

Temperature factor from Table 2b

0.6 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03 (54)

Enter (50) or (54) in (55)

1.03 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	195.01	172.14	181.39	163.44	160.78	144.53	139.64	152.08	151.45	169.44	178.11	190.6

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=	195.01	172.14	181.39	163.44	160.78	144.53	139.64	152.08	151.45	169.44	178.11	190.6

Output from water heater (annual)_{1...12}

1998.62

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.68	80.58	86.15	79.35	79.3	73.06	72.27	76.41	75.37	82.18	84.23	89.22

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34	108.34

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	16.92	15.03	12.22	9.25	6.92	5.84	6.31	8.2	11.01	13.98	16.31	17.39

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	189.79	191.76	186.79	176.23	162.89	150.36	141.98	140.01	144.98	155.54	168.88	181.41

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83	33.83

(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67	-86.67

(71)

Water heating gains (Table 5)

(72)m=	121.89	119.91	115.8	110.21	106.59	101.48	97.14	102.7	104.68	110.46	116.99	119.92

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	384.1	382.2	370.32	351.2	331.9	313.18	300.93	306.42	316.16	335.48	357.68	374.22

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
South	0.9x	0.77	x	6.9	x	46.75	x	0.5	x	0.8	=	89.42	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	6.9	x	76.57	x	0.5	x	0.8	=	146.45	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	6.9	x	97.53	x	0.5	x	0.8	=	186.55	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	6.9	x	110.23	x	0.5	x	0.8	=	210.84	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	6.9	x	114.87	x	0.5	x	0.8	=	219.71	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	6.9	x	110.55	x	0.5	x	0.8	=	211.44	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	6.9	x	108.01	x	0.5	x	0.8	=	206.59	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	6.9	x	104.89	x	0.5	x	0.8	=	200.63	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	6.9	x	101.89	x	0.5	x	0.8	=	194.87	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	6.9	x	82.59	x	0.5	x	0.8	=	157.96	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	6.9	x	55.42	x	0.5	x	0.8	=	106	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	6.9	x	40.4	x	0.5	x	0.8	=	77.27	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	150.23	254.02	341.85	412.85	451.8	443.64	429.77	401.6	366.66	279.28	179.62	128.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	534.33	636.22	712.17	764.05	783.7	756.82	730.7	708.02	682.82	614.75	537.3	502.99	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.78	0.6	0.44	0.47	0.69	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.01	20.21	20.46	20.71	20.89	20.98	21	20.99	20.95	20.71	20.3	19.96	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20	20	20	20	20	20	20	20	20	20	20	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.86	0.72	0.52	0.34	0.37	0.61	0.88	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.71	18.99	19.34	19.68	19.91	19.99	20	20	19.97	19.7	19.13	18.63	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.23	19.48	19.78	20.09	20.3	20.38	20.4	20.4	20.36	20.1	19.6	19.16	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.23	19.48	19.78	20.09	20.3	20.38	20.4	20.4	20.36	20.1	19.6	19.16	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.94	0.87	0.74	0.55	0.38	0.41	0.64	0.89	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	527.79	618.37	668.71	663.15	577.56	415.15	277.71	291.7	438.85	545.37	523.1	498.31	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1095.8	1069.93	975.08	821.57	631.34	424.55	278.85	293.44	459.71	697.58	917.17	1098.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	422.6	303.45	227.94	114.06	40.01	0	0	0	0	113.25	283.73	446.3	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1951.34 (99)

Space heating requirement in kWh/m²/year

29.2 (99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

1951.34

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

2048.91 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

1998.62

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2098.55 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

41.47 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

43.24 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

43.24 (331)

Energy for lighting (calculated in Appendix L)

298.81 (332)

12b. CO2 Emissions – Community heating scheme

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%)

If there is CHP using two fuels repeat (363) to (366) for the second fuel

93 (367a)

CO2 associated with heat source 1

[(307b)+(310b)] x 100 ÷ (367b) x

0.22

= 963.28

(367)

Electrical energy for heat distribution

[(313) x

0.52

= 21.53

(372)

Total CO2 associated with community systems

(363)...(366) + (368)...(372)

= 984.81

(373)

CO2 associated with space heating (secondary)

(309) x

0

= 0

(374)

CO2 associated with water from immersion heater or instantaneous heater

(312) x

0.22

= 0

(375)

Total CO2 associated with space and water heating

(373) + (374) + (375) =

984.81

(376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	22.44	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	155.08	(379)
Total CO2, kg/year	sum of (376)...(382) =			1162.33	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			17.39	(384)
El rating (section 14)				86.07	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-10-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	49.58 (1a) x	2.4 (2a) =	118.99 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.58 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	118.99 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			6.8	$\times 1/[1/(1.2) + 0.04]$	7.79		
Windows Type 2			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		
Windows Type 3			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 4			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		
Walls Type1	29.01	13.24	15.77	0.18	2.84		
Walls Type2	27.91	2.1	25.81	0.18	4.65		
Total area of elements, m²			56.92				
Party wall			15.1	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 25.16 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.46 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 33.63 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 53.26 53.26 53.26 53.26 53.26 53.26 53.26 53.26 53.26 53.26 53.26 53.26 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07		
Average = Sum(40) _{1...12} /12=													1.07	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

1.68

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

74.05

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	81.45	78.49	75.53	72.57	69.6	66.64	66.64	69.6	72.57	75.53	78.49	81.45		
Total = Sum(44) _{1...12} =													888.56	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	120.79	105.64	109.01	95.04	91.19	78.69	72.92	83.68	84.68	98.68	107.72	116.98		
Total = Sum(45) _{1...12} =													1165.04	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.12	15.85	16.35	14.26	13.68	11.8	10.94	12.55	12.7	14.8	16.16	17.55		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

DER WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	176.07	155.57	164.29	148.54	146.47	132.19	128.2	138.96	138.17	153.96	161.21	172.25	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	176.07	155.57	164.29	148.54	146.47	132.19	128.2	138.96	138.17	153.96	161.21	172.25	
Output from water heater (annual) _{1...12}												1815.88	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	84.38	75.07	80.47	74.4	74.54	68.96	68.47	72.04	70.95	77.03	78.61	83.12	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.03	11.57	9.41	7.12	5.33	4.5	4.86	6.32	8.48	10.76	12.56	13.39	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	146.14	147.66	143.84	135.7	125.43	115.78	109.33	107.82	111.64	119.77	130.04	139.69	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	(71)

Water heating gains (Table 5)

(72)m=	113.42	111.71	108.16	103.33	100.19	95.78	92.03	96.83	98.54	103.54	109.18	111.72	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	320.76	319.11	309.57	294.32	279.12	264.22	254.38	259.13	266.82	282.24	299.95	312.97	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)		
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)

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South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
West	0.9x	0.77	x	6.8	x	19.64	x	0.5	x	0.8	=	37.02	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	6.8	x	38.42	x	0.5	x	0.8	=	72.42	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	6.8	x	63.27	x	0.5	x	0.8	=	119.27	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	6.8	x	92.28	x	0.5	x	0.8	=	173.94	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	6.8	x	113.09	x	0.5	x	0.8	=	213.18	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	6.8	x	115.77	x	0.5	x	0.8	=	218.22	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	6.8	x	110.22	x	0.5	x	0.8	=	207.76	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	6.8	x	94.68	x	0.5	x	0.8	=	178.46	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	6.8	x	73.59	x	0.5	x	0.8	=	138.71	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	6.8	x	45.59	x	0.5	x	0.8	=	85.93	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	6.8	x	24.49	x	0.5	x	0.8	=	46.16	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	6.8	x	16.15	x	0.5	x	0.8	=	30.44	(80)

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West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	85.91	160.47	249.7	347.84	415.97	422.23	403.39	352.68	284.51	186.19	105.65	71.64	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	406.67	479.57	559.27	642.16	695.09	686.45	657.77	611.82	551.34	468.43	405.61	384.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.84	0.67	0.49	0.36	0.4	0.64	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.07	20.26	20.53	20.8	20.95	20.99	21	21	20.97	20.75	20.34	20.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.81	0.62	0.42	0.28	0.31	0.56	0.87	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.8	19.07	19.45	19.81	19.98	20.02	20.02	20.02	20	19.76	19.2	18.72	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.43	19.66	19.99	20.31	20.46	20.5	20.51	20.51	20.49	20.25	19.77	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.43	19.66	19.99	20.31	20.46	20.5	20.51	20.51	20.49	20.25	19.77	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.93	0.82	0.64	0.45	0.32	0.36	0.6	0.88	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	401.26	465.39	518.02	524.82	446.6	311.76	207.94	218.27	329.6	411.23	394.31	380.66	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	805.92	786.23	718.57	607.51	466.73	314.47	208.25	218.87	340.12	514.06	674.8	807.94	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	301.06	215.6	149.21	59.53	14.98	0	0	0	0	76.51	201.95	317.89	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1336.74 (98)

Space heating requirement in kWh/m²/year 26.96 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)
<i>The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.</i>			
Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		kWh/year	
Annual space heating requirement		1336.74	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1403.58	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1815.88	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1906.67	(310a)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	33.1	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		32.08	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	32.08	(331)
Energy for lighting (calculated in Appendix L)		230.09	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	= 768.83 (367)
Electrical energy for heat distribution	[(313) x	0.52	= 17.18 (372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)		= 786.01 (373)
CO2 associated with space heating (secondary)	(309) x	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	= 0 (375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		786.01 (376)
CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	= 16.65 (378)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for lighting	(332))) x	0.52	=	119.42	(379)
Total CO2, kg/year	sum of (376)...(382) =			922.08	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.6	(384)
El rating (section 14)				86.94	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-11-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	58.5 (1a) x	2.4 (2a) =	140.4 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	58.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	140.4 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 3			4.6	$\times 1/[1/(1.2) + 0.04]$	5.27		
Windows Type 4			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Walls Type1	40.78	12.88	27.9	0.18	5.02		
Walls Type2	29.77	2.1	27.67	0.18	4.98		
Total area of elements, m²			70.55				
Party wall			11.01	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 27.27 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.89 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.16 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	23.17	23.17	23.17	23.17	23.17	23.17	23.17	23.17	23.17	23.17	23.17	23.17

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 60.33 60.33 60.33 60.33 60.33 60.33 60.33 60.33 60.33 60.33 60.33 60.33

Stroma FSAP 2012 Version: 1.0.4.12 (SAP 9.92) - <http://www.stroma.com> Average = Sum(39)1...12 /12= 60.33 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03		
Average = Sum(40) _{1...12} /12=													1.03	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

1.94

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

80.25

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	88.27	85.06	81.85	78.64	75.43	72.22	72.22	75.43	78.64	81.85	85.06	88.27		
Total = Sum(44) _{1...12} =													962.99	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	130.91	114.49	118.15	103	98.83	85.29	79.03	90.69	91.77	106.95	116.75	126.78		
Total = Sum(45) _{1...12} =													1262.64	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	19.64	17.17	17.72	15.45	14.83	12.79	11.85	13.6	13.77	16.04	17.51	19.02		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	186.19	164.42	173.42	156.5	154.11	138.78	134.31	145.97	145.27	162.23	170.24	182.05	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	186.19	164.42	173.42	156.5	154.11	138.78	134.31	145.97	145.27	162.23	170.24	182.05	
Output from water heater (annual) _{1...12}												1913.47	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	87.75	78.01	83.51	77.04	77.08	71.15	70.5	74.38	73.31	79.78	81.61	86.38	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	96.95	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	15.08	13.39	10.89	8.25	6.16	5.2	5.62	7.31	9.81	12.46	14.54	15.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	169.15	170.9	166.48	157.06	145.18	134.01	126.54	124.79	129.21	138.63	150.51	161.69	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	-77.56	(71)

Water heating gains (Table 5)

(72)m=	117.94	116.09	112.24	107	103.61	98.82	94.76	99.97	101.82	107.23	113.35	116.1	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	354.25	352.47	341.7	324.4	307.03	290.12	279.01	284.15	292.92	310.4	330.49	345.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39 (76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39 (76)

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East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)

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South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	104.69	185.82	269.59	352.36	406.05	406.68	390.7	351.05	298.82	209.94	126.87	88.58	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	458.95	538.29	611.29	676.76	713.08	696.8	669.71	635.2	591.74	520.35	457.36	433.95	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.88	0.73	0.54	0.39	0.43	0.67	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.27	20.52	20.78	20.93	20.99	21	21	20.97	20.75	20.36	20.05	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	20.06	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.84	0.67	0.47	0.31	0.35	0.59	0.88	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.87	19.12	19.47	19.81	20	20.05	20.06	20.06	20.03	19.79	19.25	18.79	(90)

fLA = Living area ÷ (4) =

0.5	(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.48	19.7	20	20.29	20.47	20.52	20.53	20.53	20.5	20.27	19.81	19.42	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.48	19.7	20	20.29	20.47	20.52	20.53	20.53	20.5	20.27	19.81	19.42	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.94	0.85	0.7	0.51	0.35	0.39	0.63	0.89	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	453.73	524.47	573.88	576.86	497.89	352.62	236.43	248.07	372.4	463.04	446.14	430.18	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	915.75	892.75	814.21	687.33	528.81	357.11	236.94	248.96	386.15	583.34	766.61	918.14	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	343.75	247.49	178.8	79.54	23	0	0	0	0	89.5	230.74	363.05	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = (98)

Space heating requirement in kWh/m²/year

26.6	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)
<i>The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.</i>			
Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		kWh/year	
Annual space heating requirement		1555.87	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1633.67	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1913.47	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2009.15	(310a)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	36.43	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		37.85	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	37.85	(331)
Energy for lighting (calculated in Appendix L)		266.31	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	= 846.07 (367)
Electrical energy for heat distribution	[(313) x	0.52	= 18.91 (372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)		= 864.98 (373)
CO2 associated with space heating (secondary)	(309) x	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	= 0 (375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		864.98 (376)
CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	= 19.65 (378)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for lighting	(332))) x	0.52	=	138.22	(379)
Total CO2, kg/year	sum of (376)...(382) =			1022.84	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			17.48	(384)
El rating (section 14)				86.76	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-11-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	49.58 (1a) x	2.4 (2a) =	118.99 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.58 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	118.99 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 3			6.8	$\times 1/[1/(1.2) + 0.04]$	7.79		
Windows Type 4			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		
Walls Type1	33.04	13.24	19.8	0.18	3.56		
Walls Type2	23.89	2.1	21.79	0.18	3.92		
Total area of elements, m²			56.93				
Party wall			15.1	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U)

(26)...(30) + (32) = 25.17 (33)

Heat capacity Cm = S(A x k)

((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K

Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

8.53 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) = 33.7 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=	53.33	53.33	53.33	53.33	53.33	53.33	53.33	53.33	53.33	53.33	53.33	53.33

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08		
Average = Sum(40) _{1...12} /12=													1.08	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

1.68

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

74.05

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	81.45	78.49	75.53	72.57	69.6	66.64	66.64	69.6	72.57	75.53	78.49	81.45		
Total = Sum(44) _{1...12} =													888.56	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	120.79	105.64	109.01	95.04	91.19	78.69	72.92	83.68	84.68	98.68	107.72	116.98		
Total = Sum(45) _{1...12} =													1165.04	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.12	15.85	16.35	14.26	13.68	11.8	10.94	12.55	12.7	14.8	16.16	17.55		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

DER WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	176.07	155.57	164.29	148.54	146.47	132.19	128.2	138.96	138.17	153.96	161.21	172.25	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	176.07	155.57	164.29	148.54	146.47	132.19	128.2	138.96	138.17	153.96	161.21	172.25	
Output from water heater (annual) _{1...12}												1815.88	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	84.38	75.07	80.47	74.4	74.54	68.96	68.47	72.04	70.95	77.03	78.61	83.12	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.03	11.57	9.41	7.12	5.33	4.5	4.86	6.32	8.48	10.76	12.56	13.39	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	146.14	147.66	143.84	135.7	125.43	115.78	109.33	107.82	111.64	119.77	130.04	139.69	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	(71)

Water heating gains (Table 5)

(72)m=	113.42	111.71	108.16	103.33	100.19	95.78	92.03	96.83	98.54	103.54	109.18	111.72	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	320.76	319.11	309.57	294.32	279.12	264.22	254.38	259.13	266.82	282.24	299.95	312.97	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)		
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)

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South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	6.8	x	19.64	x	0.5	x	0.8	=	37.02	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	6.8	x	38.42	x	0.5	x	0.8	=	72.42	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	6.8	x	63.27	x	0.5	x	0.8	=	119.27	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	6.8	x	92.28	x	0.5	x	0.8	=	173.94	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	6.8	x	113.09	x	0.5	x	0.8	=	213.18	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	6.8	x	115.77	x	0.5	x	0.8	=	218.22	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	6.8	x	110.22	x	0.5	x	0.8	=	207.76	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	6.8	x	94.68	x	0.5	x	0.8	=	178.46	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	6.8	x	73.59	x	0.5	x	0.8	=	138.71	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	6.8	x	45.59	x	0.5	x	0.8	=	85.93	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	6.8	x	24.49	x	0.5	x	0.8	=	46.16	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)

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West $0.9 \times \boxed{0.77} \times \boxed{2.76} \times \boxed{16.15} \times \boxed{0.5} \times \boxed{0.8} = \boxed{12.36}$ (80)

West $0.9 \times \boxed{0.77} \times \boxed{6.8} \times \boxed{16.15} \times \boxed{0.5} \times \boxed{0.8} = \boxed{30.44}$ (80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=

85.91	160.47	249.7	347.84	415.97	422.23	403.39	352.68	284.51	186.19	105.65	71.64

 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=

406.67	479.57	559.27	642.16	695.09	686.45	657.77	611.82	551.34	468.43	405.61	384.61

 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.98	0.94	0.84	0.67	0.49	0.36	0.4	0.64	0.9	0.98	0.99

 (86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=

20.06	20.25	20.53	20.8	20.95	20.99	21	21	20.97	20.75	20.34	20.01

 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=

20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02

 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=

0.99	0.97	0.93	0.81	0.62	0.42	0.28	0.32	0.56	0.87	0.97	0.99

 (89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=

18.79	19.07	19.45	19.81	19.98	20.02	20.02	20.02	20	19.75	19.19	18.72

 (90)

fLA = Living area ÷ (4) =

0.5

 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=

19.43	19.66	19.99	20.3	20.46	20.5	20.51	20.51	20.49	20.25	19.77	19.37

 (92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=

19.43	19.66	19.99	20.3	20.46	20.5	20.51	20.51	20.49	20.25	19.77	19.37

 (93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=

0.99	0.97	0.93	0.82	0.64	0.45	0.32	0.36	0.6	0.88	0.97	0.99

 (94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=

401.27	465.42	518.11	525.08	447	312.11	208.18	218.52	329.92	411.35	394.33	380.66

 (95)

Monthly average external temperature from Table 8

(96)m=

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2

 (96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=

806.84	787.13	719.4	608.23	467.31	314.86	208.5	219.13	340.54	514.66	675.57	808.86

 (97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=

301.75	216.19	149.76	59.87	15.11	0	0	0	0	76.86	202.5	318.58

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

1340.61

 (98)

Space heating requirement in kWh/m²/year

27.04

 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)
<i>The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.</i>			
Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		kWh/year	
Annual space heating requirement		1340.61	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1407.64	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1815.88	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1906.67	(310a)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	33.14	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		32.08	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	32.08	(331)
Energy for lighting (calculated in Appendix L)		230.09	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	= 769.78 (367)
Electrical energy for heat distribution	[(313) x	0.52	= 17.2 (372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)		= 786.98 (373)
CO2 associated with space heating (secondary)	(309) x	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	= 0 (375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		786.98 (376)
CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	= 16.65 (378)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for lighting	(332))) x	0.52	=	119.42	(379)
Total CO2, kg/year	sum of (376)...(382) =			923.05	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.62	(384)
El rating (section 14)				86.92	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-12-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	71.98 (1a) x	2.4 (2a) =	172.75 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.98 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	172.75 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) (9)

Additional infiltration [(9)-1]x0.1 = (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 (12)

If no draught lobby, enter 0.05, else enter 0 (13)

Percentage of windows and doors draught stripped (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered (19)

Shelter factor (20) = 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.2	= 2.52		(26)
Windows Type 1			5.29	x 1/[1/(1.2)+0.04]	= 6.06		(27)
Windows Type 2			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 3			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 4			5.29	x 1/[1/(1.2)+0.04]	= 6.06		(27)
Windows Type 5			1.84	x 1/[1/(1.2)+0.04]	= 2.11		(27)
Walls Type1	41.71	17.94	23.77	x 0.18	= 4.28		(29)
Walls Type2	11.24	2.1	9.14	x 0.18	= 1.65		(29)
Roof	34.4	0	34.4	x 0.11	= 3.78		(30)
Total area of elements, m²			87.35				(31)
Party wall			43.65	x 0	= 0		(32)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 32.77 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.97 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 47.74 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=	76.25	76.25	76.25	76.25	76.25	76.25	76.25	76.25	76.25	76.25	76.25	76.25	
Average = Sum(39) _{1...12} /12=												76.25	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	
Average = Sum(40) _{1...12} /12=												1.06	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 88.66 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$	97.53	93.98	90.44	86.89	83.34	79.8	79.8	83.34	86.89	90.44	93.98	97.53	
(44)m=	97.53	93.98	90.44	86.89	83.34	79.8	79.8	83.34	86.89	90.44	93.98	97.53	
Total = Sum(44) _{1...12} =												1063.97	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.63	126.5	130.54	113.8	109.2	94.23	87.32	100.2	101.39	118.17	128.99	140.07	
Total = Sum(45) _{1...12} =												1395.03	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.7	18.97	19.58	17.07	16.38	14.13	13.1	15.03	15.21	17.72	19.35	21.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year $(48) \times (49) =$ 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) =$ 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month $((56)m = (55) \times (41)m$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

199.91	176.43	185.81	167.3	164.47	147.72	142.59	155.47	154.89	173.44	182.48	195.35

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

199.91	176.43	185.81	167.3	164.47	147.72	142.59	155.47	154.89	173.44	182.48	195.35

Output from water heater (annual) ^{1...12}	2045.87

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

92.31	82	87.62	80.63	80.53	74.13	73.25	77.54	76.51	83.51	85.68	90.8

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

18	15.98	13	9.84	7.36	6.21	6.71	8.72	11.71	14.87	17.35	18.5

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

201.87	203.97	198.69	187.45	173.27	159.93	151.03	148.93	154.21	165.45	179.63	192.97

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73

 (71)

Water heating gains (Table 5)

(72)m=

124.08	122.03	117.77	111.99	108.24	102.95	98.46	104.22	106.26	112.25	119	122.04

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

401.34	399.38	386.86	366.68	346.26	326.49	313.59	319.27	329.58	349.96	373.39	390.9

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
East	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(76)
East	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(76)
East	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(76)
East	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(76)
East	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(76)
East	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(76)
East	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(76)
East	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(76)
East	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(76)
East	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(76)
East	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(76)
East	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	66.09	127.6	213.87	329.81	427.83	450.24	423.48	346.58	253.49	151.67	81.91	54.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	467.43	526.98	600.73	696.49	774.09	776.73	737.08	665.85	583.07	501.63	455.3	445.67	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.8	0.61	0.45	0.52	0.8	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.07	20.32	20.64	20.88	20.98	21	20.99	20.92	20.59	20.19	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.91	0.75	0.52	0.35	0.41	0.72	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.61	18.81	19.17	19.62	19.93	20.02	20.03	20.03	19.97	19.56	19	18.55	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.14	19.31	19.63	20.03	20.31	20.4	20.42	20.42	20.35	19.97	19.47	19.09	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.14	19.31	19.63	20.03	20.31	20.4	20.42	20.42	20.35	19.97	19.47	19.09	(93)

8. Space heating requirement

Set $T_{i,m}$ to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, h_m :

(94)m=	0.99	0.99	0.97	0.91	0.77	0.56	0.39	0.46	0.75	0.95	0.99	1	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	465.04	521.63	584.63	636.1	593.16	433.01	289.93	303.63	435.82	476.69	450.54	443.88	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	1131.21	1098.79	1000.94	848.5	656.49	442.55	291.13	306.2	476.54	714.8	943.52	1135.09	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	495.63	387.85	309.73	152.93	47.12	0	0	0	0	177.15	354.95	514.26	

Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$ 2439.62 (98)

Space heating requirement in $kWh/m^2/year$

33.89 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2439.62

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 2561.6 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2045.87

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2148.16 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 47.1 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

46.58 (330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	46.58	(331)
Energy for lighting (calculated in Appendix L)		317.84	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1093.88 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 24.44 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1118.32 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1118.32 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 24.17 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 164.96 (379)
Total CO2, kg/year	sum of (376)...(382) =		1307.46 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		18.16 (384)
EI rating (section 14)			85.02 (385)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-12-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	110.51 (1a) x	2.4 (2a) =	265.22 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	110.51 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	265.22 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) (9)

Additional infiltration [(9)-1]x0.1 = (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 (12)

If no draught lobby, enter 0.05, else enter 0 (13)

Percentage of windows and doors draught stripped (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered (19)

Shelter factor (20) = 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors Type 1			2.1	x 1.2	= 2.52		(26)
Doors Type 2			2.1	x 1.2	= 2.52		(26)
Windows Type 1			4.6	x 1/[1/(1.2)+ 0.04]	= 5.27		(27)
Windows Type 2			4.6	x 1/[1/(1.2)+ 0.04]	= 5.27		(27)
Windows Type 3			2.76	x 1/[1/(1.2)+ 0.04]	= 3.16		(27)
Windows Type 4			2.76	x 1/[1/(1.2)+ 0.04]	= 3.16		(27)
Windows Type 5			2.76	x 1/[1/(1.2)+ 0.04]	= 3.16		(27)
Windows Type 6			2.76	x 1/[1/(1.2)+ 0.04]	= 3.16		(27)
Walls Type1	58.45	20.24	38.21	x 0.18	= 6.88		(29)
Walls Type2	49.58	4.2	45.38	x 0.18	= 8.17		(29)
Roof	21.55	0	21.55	x 0.11	= 2.37		(30)
Total area of elements, m²			129.58				(31)
Party wall			22.08	x 0	= 0		(32)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 45.63 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 19.51 (36)

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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 65.14 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	43.76	43.76	43.76	43.76	43.76	43.76	43.76	43.76	43.76	43.76	43.76	43.76	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	108.9	108.9	108.9	108.9	108.9	108.9	108.9	108.9	108.9	108.9	108.9	108.9	
(39)m=													(39)
Average = Sum(39) _{1...12} / 12 =												108.9	(40)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	
(40)m=													(40)
Average = Sum(40) _{1...12} / 12 =												0.99	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.82 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 101.12 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	111.24	107.19	103.15	99.1	95.06	91.01	91.01	95.06	99.1	103.15	107.19	111.24	(44)
Total = Sum(44) _{1...12} =												1213.49	(44)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	164.96	144.28	148.88	129.8	124.54	107.47	99.59	114.28	115.64	134.77	147.11	159.76	
(45)m=													(45)
Total = Sum(45) _{1...12} =												1591.07	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	24.74	21.64	22.33	19.47	18.68	16.12	14.94	17.14	17.35	20.22	22.07	23.96	
(46)m=													(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	220.24	194.2	204.16	183.29	179.82	160.96	154.86	169.56	169.14	190.05	200.61	215.03	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	220.24	194.2	204.16	183.29	179.82	160.96	154.86	169.56	169.14	190.05	200.61	215.03	(64)

Output from water heater (annual)_{1, 12}

2241.91

Heat gains from water heating, kWh/month 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

(65)m=	99.07	87.91	93.72	85.95	85.63	78.53	77.33	82.22	81.25	89.03	91.71	97.34	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	140.89	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	24.35	21.62	17.59	13.31	9.95	8.4	9.08	11.8	15.84	20.11	23.47	25.02	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	272.29	275.11	267.99	252.83	233.7	215.72	203.7	200.88	208	223.16	242.29	260.27	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	37.09	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	-112.71	(71)

Water heating gains (Table 5)

(72)m=	133.16	130.82	125.97	119.38	115.1	109.07	103.94	110.51	112.84	119.67	127.38	130.83	(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=	495.06	492.83	476.82	450.79	424.02	398.45	381.99	388.46	401.95	428.2	458.41	481.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04 (76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (76)
East	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99 (76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39 (76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39 (76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39 (76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39 (76)
East	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68 (76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41 (76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41 (76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41 (76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41 (76)
East	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67 (76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6 (76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6 (76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6 (76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6 (76)
East	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21 (76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52 (76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52 (76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52 (76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52 (76)
East	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62 (76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57 (76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57 (76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57 (76)
East	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54 (76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32 (76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32 (76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32 (76)
East	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72 (76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43 (76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43 (76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43 (76)

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East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 144.76 264.2 398.68 540.63 636.78 642.87 615.57 544.21 448.96 302.95 176.83 121.53 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 639.82 757.03 875.5 991.43 1060.79 1041.33 997.56 932.67 850.9 731.16 635.24 602.93 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	1	1	0.98	0.94	0.83	0.65	0.48	0.53	0.79	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.12	20.37	20.66	20.88	20.98	21	20.99	20.93	20.63	20.23	19.92	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.78	0.56	0.38	0.43	0.72	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.71	18.94	19.3	19.71	19.99	20.08	20.09	20.09	20.04	19.66	19.09	18.65	(90)

fLA = Living area ÷ (4) =	0.3	(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.08	19.29	19.62	19.99	20.25	20.35	20.36	20.36	20.31	19.95	19.43	19.03	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.08	19.29	19.62	19.99	20.25	20.35	20.36	20.36	20.31	19.95	19.43	19.03	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.92	0.79	0.59	0.41	0.46	0.74	0.95	0.99	1	(94)

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	637.81	750.79	853.87	912.87	838.47	611.98	408.49	428.73	628.57	696.17	630.51	601.55	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm, W = [(39)m × [(93)m – (96)m]

(97)m=	1610.15	1567.49	1428.62	1208.09	931.67	626.22	410.02	431.62	676.33	1018.65	1342.93	1615.05	(97)

Space heating requirement for each month, kWh/month = 0.024 × [(97)m – (95)m] × (41)m

(98)m=	723.42	548.82	427.62	212.56	69.35	0	0	0	0	239.93	512.95	754.04	(98)

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	3488.68	(99)

Space heating requirement in kWh/m²/year

31.57	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)

Fraction of space heat from community system 1 – (301) =

1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1	(303a)

Fraction of total space heat from Community boilers

(302) × (303a) =	1	(304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)

Distribution loss factor (Table 12c) for community heating system

1.05	(306)

Space heating

Annual space heating requirement

kWh/year	
3488.68	

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Space heat from Community boilers	$(98) \times (304a) \times (305) \times (306) =$	3663.11	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)
Water heating			
Annual water heating requirement		2241.91	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	2354.01	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	60.17	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		71.51	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	71.51	(331)
Energy for lighting (calculated in Appendix L)		429.97	(332)
12b. CO2 Emissions – Community heating scheme			
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	$\text{If there is CHP using two fuels repeat (363) to (366) for the second fuel}$	93	(367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1397.52 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 31.23 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1428.75 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1428.75 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 37.11 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 223.16 (379)
Total CO2, kg/year	$\text{sum of (376)...(382) =}$		1689.02 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		15.28 (384)
El rating (section 14)			85.45 (385)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-12-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	49.58 (1a) x	2.4 (2a) =	118.99 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.58 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	118.99 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) (9)

Additional infiltration [(9)-1]x0.1 = (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 (12)

If no draught lobby, enter 0.05, else enter 0 (13)

Percentage of windows and doors draught stripped (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered (19)

Shelter factor (20) = 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 2			6.8	$\times 1/[1/(1.2) + 0.04]$	7.79		
Windows Type 3			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		
Windows Type 4			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		
Walls Type1	33.04	13.24	19.8	0.18	3.56		
Walls Type2	23.89	2.1	21.79	0.18	3.92		
Roof	5.9	0	5.9	0.11	0.65		
Total area of elements, m²			62.83				
Party wall			15.1	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 25.82 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.69 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.51 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=

19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

57.14	57.14	57.14	57.14	57.14	57.14	57.14	57.14	57.14	57.14	57.14	57.14

Average = Sum(39)_{1...12} /12=

57.14 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15

Average = Sum(40)_{1...12} /12=

1.15 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

1.68 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

74.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

81.45	78.49	75.53	72.57	69.6	66.64	66.64	69.6	72.57	75.53	78.49	81.45

Total = Sum(44)_{1...12} =

888.56 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

120.79	105.64	109.01	95.04	91.19	78.69	72.92	83.68	84.68	98.68	107.72	116.98

Total = Sum(45)_{1...12} =

1165.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

18.12	15.85	16.35	14.26	13.68	11.8	10.94	12.55	12.7	14.8	16.16	17.55

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03 (52)

Temperature factor from Table 2b

0.6 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03 (54)

Enter (50) or (54) in (55)

1.03 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

DER WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

176.07	155.57	164.29	148.54	146.47	132.19	128.2	138.96	138.17	153.96	161.21	172.25

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=

176.07	155.57	164.29	148.54	146.47	132.19	128.2	138.96	138.17	153.96	161.21	172.25

Output from water heater (annual)_{1...12}

1815.88

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=

84.38	75.07	80.47	74.4	74.54	68.96	68.47	72.04	70.95	77.03	78.61	83.12

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89	83.89

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

13.03	11.57	9.41	7.12	5.33	4.5	4.86	6.32	8.48	10.76	12.56	13.39

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

146.14	147.66	143.84	135.7	125.43	115.78	109.33	107.82	111.64	119.77	130.04	139.69

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39

(69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11	-67.11

(71)

Water heating gains (Table 5)

(72)m=

113.42	111.71	108.16	103.33	100.19	95.78	92.03	96.83	98.54	103.54	109.18	111.72

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

320.76	319.11	309.57	294.32	279.12	264.22	254.38	259.13	266.82	282.24	299.95	312.97

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)

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South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	6.8	x	19.64	x	0.5	x	0.8	=	37.02	(80)
West	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	6.8	x	38.42	x	0.5	x	0.8	=	72.42	(80)
West	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	6.8	x	63.27	x	0.5	x	0.8	=	119.27	(80)
West	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	6.8	x	92.28	x	0.5	x	0.8	=	173.94	(80)
West	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	6.8	x	113.09	x	0.5	x	0.8	=	213.18	(80)
West	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	6.8	x	115.77	x	0.5	x	0.8	=	218.22	(80)
West	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	6.8	x	110.22	x	0.5	x	0.8	=	207.76	(80)
West	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	6.8	x	94.68	x	0.5	x	0.8	=	178.46	(80)
West	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	6.8	x	73.59	x	0.5	x	0.8	=	138.71	(80)
West	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	6.8	x	45.59	x	0.5	x	0.8	=	85.93	(80)
West	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)

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West	0.9x	0.77	x	6.8	x	24.49	x	0.5	x	0.8	=	46.16	(80)
West	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	6.8	x	16.15	x	0.5	x	0.8	=	30.44	(80)
West	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	85.91	160.47	249.7	347.84	415.97	422.23	403.39	352.68	284.51	186.19	105.65	71.64	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	406.67	479.57	559.27	642.16	695.09	686.45	657.77	611.82	551.34	468.43	405.61	384.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	0.99	0.98	0.95	0.86	0.71	0.52	0.38	0.43	0.67	0.92	0.98	0.99	

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.96	20.15	20.44	20.74	20.92	20.99	21	21	20.95	20.69	20.25	19.91	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.83	0.64	0.44	0.29	0.33	0.59	0.88	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.59	18.87	19.28	19.68	19.89	19.95	19.96	19.96	19.93	19.62	19.02	18.52	(90)

fLA = Living area ÷ (4) =

0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.27	19.51	19.86	20.21	20.41	20.47	20.48	20.48	20.44	20.16	19.64	19.21	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.27	19.51	19.86	20.21	20.41	20.47	20.48	20.48	20.44	20.16	19.64	19.21	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.93	0.84	0.67	0.48	0.34	0.38	0.63	0.89	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	401.5	466.46	522.14	537.12	467.04	330.52	220.94	231.78	345.88	417.2	395.12	380.79	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	855.68	834.8	763.21	646.23	497.54	335.3	221.56	232.92	362.31	545.99	716.27	857.84	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	337.91	247.53	179.36	78.56	22.69	0	0	0	0	95.82	231.23	354.92	

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1548.01 (98)

Space heating requirement in kWh/m²/year

31.22 (99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

1548.01

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

1625.41 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

1815.88

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

1906.67 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

35.32 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

32.08 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

32.08 (331)

Energy for lighting (calculated in Appendix L)

230.09 (332)

12b. CO2 Emissions – Community heating scheme

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%)

If there is CHP using two fuels repeat (363) to (366) for the second fuel

93 (367a)

CO2 associated with heat source 1

[(307b)+(310b)] x 100 ÷ (367b) x

0.22

= 820.35 (367)

Electrical energy for heat distribution

[(313) x

0.52

= 18.33 (372)

Total CO2 associated with community systems

(363)...(366) + (368)...(372)

= 838.69 (373)

CO2 associated with space heating (secondary)

(309) x

0

= 0 (374)

CO2 associated with water from immersion heater or instantaneous heater (312) x

0.22

= 0 (375)

Total CO2 associated with space and water heating

(373) + (374) + (375) =

838.69 (376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	=	16.65	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	119.42	(379)
Total CO2, kg/year	sum of (376)...(382) =			974.75	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			19.66	(384)
El rating (section 14)				86.19	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-12-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	73.39 (1a) x	2.4 (2a) =	176.14 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.39 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.14 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0 +	0 +	0 =	0 x 40 =	0 (6a)
Number of open flues	0 +	0 +	0 =	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.2	= 2.52		(26)
Windows Type 1			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 2			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 3			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 4			6.9	x 1/[1/(1.2)+0.04]	= 7.9		(27)
Windows Type 5			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Walls Type1	40.92	17.94	22.98	x 0.18	= 4.14		(29)
Walls Type2	21.61	2.1	19.51	x 0.18	= 3.51		(29)
Roof	24.37	0	24.37	x 0.11	= 2.68		(30)
Total area of elements, m²			86.9				(31)
Party wall			38.59	x 0	= 0		(32)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 33.39 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.43 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 47.82 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

76.88	76.88	76.88	76.88	76.88	76.88	76.88	76.88	76.88	76.88	76.88	76.88

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

76.88

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

1.05

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.33

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

89.43

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
98.37	94.8	91.22	87.64	84.07	80.49	80.49	84.07	87.64	91.22	94.8	98.37

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1073.18

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

145.89	127.59	131.67	114.79	110.14	95.04	88.07	101.06	102.27	119.19	130.1	141.28

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1407.11

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

21.88	19.14	19.75	17.22	16.52	14.26	13.21	15.16	15.34	17.88	19.52	21.19

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(56)

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

201.16	177.52	186.94	168.28	165.42	148.54	143.35	156.34	155.77	174.46	183.6	196.56

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

201.16	177.52	186.94	168.28	165.42	148.54	143.35	156.34	155.77	174.46	183.6	196.56

Output from water heater (annual) ^{1...12}	2057.94

 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

(65)m=

92.73	82.37	88	80.96	80.84	74.4	73.51	77.83	76.8	83.85	86.05	91.2

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

18.28	16.24	13.21	10	7.47	6.31	6.82	8.86	11.89	15.1	17.63	18.79

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

205.08	207.2	201.84	190.43	176.01	162.47	153.42	151.29	156.66	168.07	182.48	196.03

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02

 (71)

Water heating gains (Table 5)

(72)m=

124.64	122.57	118.28	112.45	108.66	103.33	98.8	104.6	106.67	112.7	119.52	122.58

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

405.88	403.9	391.21	370.75	350.03	329.99	316.92	322.64	333.1	353.76	377.51	395.28

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	6.9	x	19.64	x	0.5	x	0.8	=	37.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	6.9	x	38.42	x	0.5	x	0.8	=	73.49	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	6.9	x	63.27	x	0.5	x	0.8	=	121.02	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	6.9	x	92.28	x	0.5	x	0.8	=	176.5	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	6.9	x	113.09	x	0.5	x	0.8	=	216.31	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	6.9	x	115.77	x	0.5	x	0.8	=	221.43	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	6.9	x	110.22	x	0.5	x	0.8	=	210.81	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	6.9	x	94.68	x	0.5	x	0.8	=	181.08	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	6.9	x	73.59	x	0.5	x	0.8	=	140.75	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	6.9	x	45.59	x	0.5	x	0.8	=	87.2	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	6.9	x	24.49	x	0.5	x	0.8	=	46.84	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	6.9	x	16.15	x	0.5	x	0.8	=	30.89	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	83.89	163.37	270.67	402.57	503.68	520.97	493.73	416.61	316.88	193.97	104.38	69.17	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	489.77	567.26	661.89	773.33	853.72	850.96	810.65	739.25	649.98	547.73	481.9	464.45	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	1	0.99	0.98	0.91	0.76	0.57	0.42	0.47	0.75	0.96	0.99	1	

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.96	20.12	20.39	20.71	20.91	20.99	21	21	20.94	20.64	20.23	19.92	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.7	0.49	0.33	0.38	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.66	18.89	19.28	19.71	19.97	20.04	20.04	20.04	20	19.64	19.05	18.6	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.18	19.38	19.72	20.11	20.35	20.42	20.42	20.42	20.38	20.04	19.52	19.13	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

DER WorkSheet: New dwelling design stage

(93)m=	19.18	19.38	19.72	20.11	20.35	20.42	20.42	20.42	20.38	20.04	19.52	19.13	(93)

8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, h_m :

(94)m=	0.99	0.99	0.96	0.89	0.72	0.52	0.36	0.42	0.7	0.94	0.99	1	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	486.93	559.97	637.77	685.26	617.29	440.51	293.3	307.73	453.57	512.73	475.97	462.39	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	1144.24	1113.51	1016.52	861.86	664.73	447.1	294.08	309.34	482.63	725.61	955.24	1147.77	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	489.04	371.98	281.79	127.15	35.29	0	0	0	0	158.39	345.08	509.92	

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 2318.64 (98)

Space heating requirement in $kWh/m^2/year$

31.59 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2318.64

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

2434.57 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2057.94

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2160.84 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$

45.95 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

47.49 (330a)

DER WorkSheet: New dwelling design stage

warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	47.49	(331)
Energy for lighting (calculated in Appendix L)		322.88	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1067.32 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 23.85 (372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$		= 1091.17 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1091.17 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 24.65 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 167.57 (379)
Total CO2, kg/year	sum of (376) ... (382) =		1283.39 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		17.49 (384)
EI rating (section 14)			85.47 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-13-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	52.79 (1a)	2.4 (2a)	126.7 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.79 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	126.7 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	0.85 (20)

Infiltration rate incorporating shelter factor	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		(26)
Windows Type 1			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		(27)
Windows Type 2			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		(27)
Windows Type 3			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		(27)
Windows Type 4			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		(27)
Windows Type 5			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		(27)
Windows Type 6			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		(27)
Walls Type1	37.11	16.56	20.55	0.18	3.7		(29)
Walls Type2	24.51	2.1	22.41	0.18	4.03		(29)
Roof	52.79	0	52.79	0.11	5.81		(30)
Total area of elements, m²			114.41				(31)
Party wall			3.53	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 35.02 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 17.05 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 52.07 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	72.97	72.97	72.97	72.97	72.97	72.97	72.97	72.97	72.97	72.97	72.97	72.97	
Average = Sum(39) _{1...12} / 12 =												72.97	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	
Average = Sum(40) _{1...12} / 12 =												1.38	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.77 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 76.29 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													

(44)m=	83.92	80.87	77.82	74.77	71.72	68.66	68.66	71.72	74.77	77.82	80.87	83.92	
Total = Sum(44) _{1...12} =												915.53	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	124.46	108.85	112.32	97.93	93.96	81.08	75.13	86.22	87.25	101.68	110.99	120.53	
Total = Sum(45) _{1...12} =												1200.4	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.67	16.33	16.85	14.69	14.09	12.16	11.27	12.93	13.09	15.25	16.65	18.08	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) × (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.73	158.78	167.6	151.42	149.24	134.58	130.41	141.5	140.74	156.96	164.48	175.81	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.73	158.78	167.6	151.42	149.24	134.58	130.41	141.5	140.74	156.96	164.48	175.81	
Output from water heater (annual) _{1, 12}												1851.24	(64)

Heat gains from water heating, kWh/month 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

(65)m=	85.6	76.13	81.57	75.36	75.46	69.75	69.2	72.89	71.8	78.03	79.7	84.3	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	88.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.77	12.23	9.95	7.53	5.63	4.75	5.14	6.68	8.96	11.38	13.28	14.15	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	154.47	156.08	152.04	143.44	132.58	122.38	115.56	113.96	118	126.6	137.46	147.66	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	31.86	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	-70.89	(71)

Water heating gains (Table 5)

(72)m=	115.06	113.3	109.64	104.66	101.43	96.88	93.02	97.97	99.73	104.88	110.69	113.3	(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=	332.89	331.19	321.21	305.21	289.23	273.6	263.3	268.19	276.28	292.44	311.01	324.7	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)

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East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 69.48 134.82 224.48 339.11 431.06 449.3 424.37 353.28 264.19 160.16 86.32 57.42 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 402.37 466.01 545.69 644.32 720.29 722.9 687.67 621.48 540.47 452.6 397.33 382.12 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.99	0.97	0.92	0.79	0.61	0.46	0.52	0.78	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.6	19.78	20.1	20.5	20.81	20.95	20.99	20.98	20.86	20.44	19.94	19.56	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.78	19.78	19.78	19.78	19.78	19.78	19.78	19.78	19.78	19.78	19.78	19.78	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.89	0.72	0.51	0.34	0.39	0.69	0.93	0.99	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.95	18.21	18.67	19.22	19.61	19.75	19.77	19.77	19.68	19.16	18.44	17.88	(90)

fLA = Living area ÷ (4) =	0.5	(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.78	19	19.38	19.86	20.21	20.35	20.38	20.38	20.27	19.8	19.19	18.72	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.78	19	19.38	19.86	20.21	20.35	20.38	20.38	20.27	19.8	19.19	18.72	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.89	0.75	0.56	0.4	0.46	0.73	0.93	0.98	0.99	(94)

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	398.61	457.75	522.96	572.95	538.96	402.21	272.81	284.41	395.78	422.39	390.43	379.21	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm, W = [(39)m × [(93)m – (96)m]

(97)m=	1056.51	1028.68	940.17	799.86	620.93	419.71	275.95	290.13	450.25	671.38	882.38	1059.67	(97)

Space heating requirement for each month, kWh/month = 0.024 × [(97)m – (95)m] × (41)m

(98)m=	489.48	383.66	310.41	163.37	60.98	0	0	0	0	185.25	354.2	506.26	

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	2453.62	(98)

Space heating requirement in kWh/m²/year

46.48	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)

Fraction of space heat from community system 1 – (301) =

1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1	(303a)

Fraction of total space heat from Community boilers

(302) × (303a) =	1	(304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)

Distribution loss factor (Table 12c) for community heating system

1.05	(306)

Space heating

Annual space heating requirement

kWh/year	
2453.62	

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Space heat from Community boilers	$(98) \times (304a) \times (305) \times (306) =$	2576.3	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)

Water heating

Annual water heating requirement		1851.24	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	1943.8	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	45.2	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		34.16	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	34.16	(331)
Energy for lighting (calculated in Appendix L)		243.21	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1049.83 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 23.46 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1073.29 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1073.29 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 17.73 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 126.23 (379)
Total CO2, kg/year	sum of (376)...(382) =		1217.24 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		23.06 (384)
EI rating (section 14)			83.32 (385)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-13-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	54.69 (1a) x	2.4 (2a) =	131.26 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54.69 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	131.26 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		
Windows Type 2			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		
Windows Type 3			6.93	$\times 1/[1/(1.2) + 0.04]$	7.94		
Windows Type 4			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 5			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Walls Type1	39.6	16.13	23.47	0.18	4.22		
Walls Type2	33.71	2.1	31.61	0.18	5.69		
Roof	54.69	0	54.69	0.11	6.02		
Total area of elements, m²			128				

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 36.92 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.25 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 51.17 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=

21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

72.83	72.83	72.83	72.83	72.83	72.83	72.83	72.83	72.83	72.83	72.83	72.83

Average = Sum(39)_{1...12} /12=

72.83

 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33

Average = Sum(40)_{1...12} /12=

1.33

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

1.83

 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

77.62

 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

85.38	82.28	79.17	76.07	72.96	69.86	69.86	72.96	76.07	79.17	82.28	85.38

Total = Sum(44)_{1...12} =

931.46

 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

126.62	110.74	114.28	99.63	95.6	82.49	76.44	87.72	88.77	103.45	112.92	122.63

Total = Sum(45)_{1...12} =

1221.29

 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

18.99	16.61	17.14	14.94	14.34	12.37	11.47	13.16	13.31	15.52	16.94	18.39

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

 (48)

Temperature factor from Table 2b

0

 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110

 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

 (52)

Temperature factor from Table 2b

0.6

 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03

 (54)

Enter (50) or (54) in (55)

1.03

 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.9	160.67	169.55	153.12	150.87	135.99	131.72	143	142.26	158.73	166.42	177.9

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=	181.9	160.67	169.55	153.12	150.87	135.99	131.72	143	142.26	158.73	166.42	177.9

Output from water heater (annual)_{1...12}

1872.13

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.32	76.76	82.22	75.92	76.01	70.22	69.64	73.39	72.31	78.62	80.34	84.99

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41	91.41

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.21	12.62	10.26	7.77	5.81	4.9	5.3	6.89	9.24	11.74	13.7	14.6

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	159.39	161.04	156.87	148	136.8	126.27	119.24	117.59	121.75	130.63	141.83	152.35

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14	32.14

(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13	-73.13

(71)

Water heating gains (Table 5)

(72)m=	116.03	114.23	110.51	105.45	102.16	97.53	93.6	98.64	100.43	105.67	111.59	114.24

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.05	338.32	328.07	311.64	295.19	279.13	268.56	273.54	281.85	298.46	317.54	331.62

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02 (76)
East	0.9x	0.77	x	1.84	x	19.64	x	0.5	x	0.8	=	10.02 (76)

(76)

(76)

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East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(76)
East	0.9x	0.77	x	1.84	x	38.42	x	0.5	x	0.8	=	19.6	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(76)
East	0.9x	0.77	x	1.84	x	63.27	x	0.5	x	0.8	=	32.27	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(76)
East	0.9x	0.77	x	1.84	x	92.28	x	0.5	x	0.8	=	47.07	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(76)
East	0.9x	0.77	x	1.84	x	113.09	x	0.5	x	0.8	=	57.68	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(76)
East	0.9x	0.77	x	1.84	x	115.77	x	0.5	x	0.8	=	59.05	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(76)
East	0.9x	0.77	x	1.84	x	110.22	x	0.5	x	0.8	=	56.22	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(76)
East	0.9x	0.77	x	1.84	x	94.68	x	0.5	x	0.8	=	48.29	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(76)
East	0.9x	0.77	x	1.84	x	73.59	x	0.5	x	0.8	=	37.53	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(76)
East	0.9x	0.77	x	1.84	x	45.59	x	0.5	x	0.8	=	23.25	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(76)
East	0.9x	0.77	x	1.84	x	24.49	x	0.5	x	0.8	=	12.49	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)

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East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(76)
East	0.9x	0.77	x	1.84	x	16.15	x	0.5	x	0.8	=	8.24	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
South	0.9x	0.77	x	6.93	x	46.75	x	0.5	x	0.8	=	89.81	(78)
South	0.9x	0.77	x	6.93	x	76.57	x	0.5	x	0.8	=	147.09	(78)
South	0.9x	0.77	x	6.93	x	97.53	x	0.5	x	0.8	=	187.36	(78)
South	0.9x	0.77	x	6.93	x	110.23	x	0.5	x	0.8	=	211.76	(78)
South	0.9x	0.77	x	6.93	x	114.87	x	0.5	x	0.8	=	220.67	(78)
South	0.9x	0.77	x	6.93	x	110.55	x	0.5	x	0.8	=	212.36	(78)
South	0.9x	0.77	x	6.93	x	108.01	x	0.5	x	0.8	=	207.49	(78)
South	0.9x	0.77	x	6.93	x	104.89	x	0.5	x	0.8	=	201.5	(78)
South	0.9x	0.77	x	6.93	x	101.89	x	0.5	x	0.8	=	195.72	(78)
South	0.9x	0.77	x	6.93	x	82.59	x	0.5	x	0.8	=	158.65	(78)
South	0.9x	0.77	x	6.93	x	55.42	x	0.5	x	0.8	=	106.46	(78)
South	0.9x	0.77	x	6.93	x	40.4	x	0.5	x	0.8	=	77.6	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	139.9	245.07	348.72	447.1	509.08	507.6	488.57	442.95	383.39	274.91	168.91	118.79	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	479.94	583.39	676.79	758.74	804.27	786.74	757.14	716.49	665.24	573.37	486.45	450.42	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.87	0.74	0.57	0.42	0.46	0.69	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.77	20	20.31	20.64	20.86	20.97	20.99	20.99	20.93	20.61	20.11	19.71	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.82	19.82	19.82	19.82	19.82	19.82	19.82	19.82	19.82	19.82	19.82	19.82	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.84	0.67	0.47	0.31	0.35	0.59	0.88	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.22	18.55	18.99	19.42	19.7	19.8	19.81	19.81	19.77	19.4	18.71	18.13	(90)

fLA = Living area ÷ (4) =

0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.99	19.27	19.65	20.03	20.28	20.38	20.4	20.4	20.35	20.01	19.41	18.92	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.99	19.27	19.65	20.03	20.28	20.38	20.4	20.4	20.35	20.01	19.41	18.92	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.98	0.97	0.93	0.84	0.7	0.52	0.36	0.4	0.64	0.88	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	472.54	563.73	627.44	639.88	564.81	408.8	275.06	288.3	424.9	505.69	471.52	444.99	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1070.09	1046.82	957.54	810.59	624.97	421.13	277.02	291.41	454.86	685.04	896.61	1072.11	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	444.57	324.64	245.59	122.91	44.76	0	0	0	0	133.44	306.07	466.58	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2088.55 (98)

Space heating requirement in kWh/m²/year

38.19 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2088.55

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 2192.97 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

1872.13

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 1965.73 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] = 41.59 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

35.39 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) = 35.39 (331)

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Energy for lighting (calculated in Appendix L)

250.94

(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 965.89 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 21.58 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 987.48 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		987.48 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 18.37 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 130.24 (379)
Total CO2, kg/year	sum of (376)...(382) =		1136.08 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		20.77 (384)
EI rating (section 14)			84.73 (385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-13-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	52.6 (1a)	2.4 (2a)	126.24 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.6 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	126.24 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 2			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 3			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 4			6.99	$\times 1/[1/(1.2)+0.04]$	8		
Walls Type1	35.49	15.27	20.22	0.18	3.64		
Walls Type2	26.7	2.1	24.6	0.18	4.43		
Roof	52.6	0	52.6	0.11	5.79		
Total area of elements, m²			114.79				
Party wall			15.58	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 33.86 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.38 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.24 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=

20.83	20.83	20.83	20.83	20.83	20.83	20.83	20.83	20.83	20.83	20.83	20.83

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

67.07	67.07	67.07	67.07	67.07	67.07	67.07	67.07	67.07	67.07	67.07	67.07

Average = Sum(39)_{1...12} /12=

67.07 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28

Average = Sum(40)_{1...12} /12=

1.28 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

1.77 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

76.16 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

83.78	80.73	77.68	74.64	71.59	68.54	68.54	71.59	74.64	77.68	80.73	83.78

Total = Sum(44)_{1...12} =

913.93 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

124.24	108.66	112.13	97.76	93.8	80.94	75	86.07	87.1	101.5	110.8	120.32

Total = Sum(45)_{1...12} =

1198.31 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

18.64	16.3	16.82	14.66	14.07	12.14	11.25	12.91	13.06	15.23	16.62	18.05

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03 (52)

Temperature factor from Table 2b

0.6 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03 (54)

Enter (50) or (54) in (55)

1.03 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

DER WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.52	158.59	167.4	151.25	149.08	134.43	130.28	141.34	140.59	156.78	164.29	175.6

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=	179.52	158.59	167.4	151.25	149.08	134.43	130.28	141.34	140.59	156.78	164.29	175.6

Output from water heater (annual)_{1...12}

1849.15

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.53	76.07	81.5	75.3	75.41	69.71	69.16	72.84	71.75	77.97	79.63	84.23

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34	88.34

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.73	12.19	9.92	7.51	5.61	4.74	5.12	6.65	8.93	11.34	13.24	14.11

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	153.98	155.58	151.55	142.98	132.16	121.99	115.2	113.6	117.63	126.2	137.02	147.19

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83	31.83

(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67	-70.67

(71)

Water heating gains (Table 5)

(72)m=	114.96	113.2	109.55	104.58	101.36	96.82	92.96	97.9	99.66	104.8	110.6	113.21

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	332.17	330.48	320.52	304.57	288.63	273.05	262.77	267.66	275.72	291.84	310.36	324.01

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
South	0.9x	0.77	x	6.99	x	46.75	x	0.5	x	0.8	=	90.59	(78)
South	0.9x	0.77	x	6.99	x	76.57	x	0.5	x	0.8	=	148.36	(78)

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South	0.9x	0.77	x	6.99	x	97.53	x	0.5	x	0.8	=	188.98	(78)
South	0.9x	0.77	x	6.99	x	110.23	x	0.5	x	0.8	=	213.59	(78)
South	0.9x	0.77	x	6.99	x	114.87	x	0.5	x	0.8	=	222.58	(78)
South	0.9x	0.77	x	6.99	x	110.55	x	0.5	x	0.8	=	214.2	(78)
South	0.9x	0.77	x	6.99	x	108.01	x	0.5	x	0.8	=	209.29	(78)
South	0.9x	0.77	x	6.99	x	104.89	x	0.5	x	0.8	=	203.25	(78)
South	0.9x	0.77	x	6.99	x	101.89	x	0.5	x	0.8	=	197.42	(78)
South	0.9x	0.77	x	6.99	x	82.59	x	0.5	x	0.8	=	160.02	(78)
South	0.9x	0.77	x	6.99	x	55.42	x	0.5	x	0.8	=	107.38	(78)
South	0.9x	0.77	x	6.99	x	40.4	x	0.5	x	0.8	=	78.28	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)

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West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	135.67	236.54	334.21	425.4	482.15	479.92	462.26	420.55	366.32	264.66	163.59	115.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	467.84	567.02	654.73	729.97	770.78	752.96	725.04	688.2	642.04	556.49	473.94	439.35	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.86	0.73	0.55	0.4	0.44	0.67	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.85	20.08	20.38	20.68	20.89	20.98	21	20.99	20.94	20.66	20.18	19.79	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.86	19.86	19.86	19.86	19.86	19.86	19.86	19.86	19.86	19.86	19.86	19.86	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.83	0.66	0.46	0.3	0.34	0.58	0.86	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.37	18.7	19.12	19.52	19.76	19.85	19.86	19.86	19.82	19.5	18.85	18.29	(90)

fLA = Living area ÷ (4) =

0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.11	19.39	19.75	20.1	20.33	20.41	20.43	20.43	20.38	20.08	19.51	19.04	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.11	19.39	19.75	20.1	20.33	20.41	20.43	20.43	20.38	20.08	19.51	19.04	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.98	0.96	0.92	0.83	0.69	0.51	0.35	0.39	0.62	0.87	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	460.16	546.55	603.68	608.83	530.82	380.57	255.32	267.81	398.56	485.53	458.27	433.74	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	993.45	971.77	888.47	751.31	578.51	389.7	256.68	269.97	421.25	635.82	832.64	995.32	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	396.77	285.75	211.89	102.59	35.48	0	0	0	0	111.82	269.55	417.82	

Total per year (kWh/year) = Sum(98)1...5,9...12 = 1831.66 (98)

Space heating requirement in kWh/m²/year

34.82 (99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

1831.66

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

1923.24 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

1849.15

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

1941.6 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

38.65 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

34.04 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

34.04 (331)

Energy for lighting (calculated in Appendix L)

242.43 (332)

12b. CO2 Emissions – Community heating scheme

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%)

If there is CHP using two fuels repeat (363) to (366) for the second fuel

93 (367a)

CO2 associated with heat source 1

[(307b)+(310b)] x 100 ÷ (367b) x

0.22

= 897.64 (367)

Electrical energy for heat distribution

[(313) x

0.52

= 20.06 (372)

Total CO2 associated with community systems

(363)...(366) + (368)...(372)

= 917.7 (373)

CO2 associated with space heating (secondary)

(309) x

0

= 0 (374)

CO2 associated with water from immersion heater or instantaneous heater (312) x

0.22

= 0 (375)

Total CO2 associated with space and water heating

(373) + (374) + (375) =

917.7 (376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	=	17.67	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	125.82	(379)
Total CO2, kg/year	sum of (376)...(382) =			1061.19	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			20.17	(384)
El rating (section 14)				85.43	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-13-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	50.5 (1a)	2.4 (2a)	121.2 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	121.2 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 2			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 3			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 4			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 5			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 6			1.84	$\times 1/[1/(1.2)+0.04]$	2.11		
Walls Type1	37.87	15.64	22.23	0.18	4		
Walls Type2	19.95	2.1	17.85	0.18	3.21		
Roof	50.5	0	50.5	0.11	5.55		
Total area of elements, m²			108.32				
Party wall			17.92	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 33.2 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 48.16 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m × (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20	20	20	20	20	20	20	20	20	20	20	20	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	68.16	68.16	68.16	68.16	68.16	68.16	68.16	68.16	68.16	68.16	68.16	68.16	
Average = Sum(39) _{1...12} / 12 =												68.16	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	
Average = Sum(40) _{1...12} / 12 =												1.35	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.7 (42)

if TFA > 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA - 13.9)²)] + 0.0013 × (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 × N) + 36 74.69 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c × (43)													

(44)m=	82.16	79.17	76.18	73.2	70.21	67.22	67.22	70.21	73.2	76.18	79.17	82.16	
Total = Sum(44) _{1...12} =												896.28	(44)

Energy content of hot water used - calculated monthly = 4.190 × Vd,m × nm × DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.84	106.56	109.96	95.87	91.99	79.38	73.56	84.41	85.41	99.54	108.66	117.99	
Total = Sum(45) _{1...12} =												1175.16	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.28	15.98	16.49	14.38	13.8	11.91	11.03	12.66	12.81	14.93	16.3	17.7	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) × (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

177.12	156.49	165.24	149.36	147.26	132.87	128.83	139.68	138.91	154.82	162.15	173.27

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

177.12	156.49	165.24	149.36	147.26	132.87	128.83	139.68	138.91	154.82	162.15	173.27

 Output from water heater (annual)_{1, 12} 1826 (64)

Heat gains from water heating, kWh/month 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

(65)m=

84.73	75.37	80.78	74.67	74.81	69.19	68.68	72.29	71.19	77.32	78.92	83.45

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

13.24	11.76	9.56	7.24	5.41	4.57	4.94	6.42	8.61	10.94	12.77	13.61

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

148.53	150.07	146.19	137.92	127.48	117.67	111.12	109.58	113.46	121.73	132.17	141.98

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19

 (71)

Water heating gains (Table 5)

(72)m=

113.89	112.16	108.58	103.71	100.55	96.09	92.31	97.16	98.88	103.92	109.62	112.17

 (72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=

324.24	322.57	312.91	297.44	282.02	266.91	256.94	261.73	269.53	285.17	303.12	316.33

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14 (74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14 (74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42 (74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55 (74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55 (74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36 (74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42 (74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42 (74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61 (74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43 (74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43 (74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29 (74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16 (74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16 (74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11 (74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19 (74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19 (74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8 (74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13 (74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13 (74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09 (74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33 (74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33 (74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22 (74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76 (74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76 (74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18 (74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51 (74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51 (74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34 (74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04 (74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04 (74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69 (74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78 (74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78 (74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52 (74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03 (80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 66.77 129.64 215.67 324.96 412.01 428.9 405.33 338.18 253.61 153.99 82.97 55.16 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 391.01 452.21 528.58 622.41 694.02 695.81 662.27 599.9 523.14 439.15 386.09 371.49 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(86)m=	0.99	0.99	0.97	0.91	0.78	0.59	0.45	0.51	0.77	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.66	19.83	20.15	20.54	20.83	20.96	20.99	20.98	20.88	20.48	19.99	19.61	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.88	0.71	0.5	0.33	0.38	0.68	0.93	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.04	18.3	18.75	19.29	19.65	19.78	19.8	19.8	19.71	19.22	18.53	17.98	(90)

fLA = Living area ÷ (4) =	0.5	(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.85	19.07	19.45	19.91	20.24	20.37	20.4	20.39	20.3	19.85	19.26	18.79	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.85	19.07	19.45	19.91	20.24	20.37	20.4	20.39	20.3	19.85	19.26	18.79	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.88	0.74	0.54	0.39	0.45	0.72	0.93	0.98	0.99	(94)

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	387.15	443.73	505.26	549.77	512.08	378.92	256.21	267.45	376.46	407.93	378.98	368.51	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm, W = [(39)m × [(93)m – (96)m]

(97)m=	991.68	965.63	882.6	750.59	582.09	393.21	258.67	271.98	422.34	630.51	828.47	994.63	(97)

Space heating requirement for each month, kWh/month = 0.024 × [(97)m – (95)m] × (41)m

(98)m=	449.77	350.72	280.74	144.59	52.09	0	0	0	0	165.6	323.63	465.83	

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	2232.97	(98)

Space heating requirement in kWh/m²/year

44.22	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)

Fraction of space heat from community system 1 – (301) =

1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1	(303a)

Fraction of total space heat from Community boilers

(302) × (303a) =	1	(304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)

Distribution loss factor (Table 12c) for community heating system

1.05	(306)

Space heating

Annual space heating requirement

kWh/year	
2232.97	

DER WorkSheet: New dwelling design stage

Space heat from Community boilers	$(98) \times (304a) \times (305) \times (306) =$	2344.62	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)

Water heating

Annual water heating requirement		1826	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	1917.3	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	42.62	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		32.68	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	32.68	(331)
Energy for lighting (calculated in Appendix L)		233.85	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 989.87 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 22.12 (372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$		= 1011.98 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1011.98 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 16.96 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 121.37 (379)
Total CO2, kg/year	sum of (376)...(382) =		1150.31 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		22.78 (384)
El rating (section 14)			83.86 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-2-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	71.98 (1a) x	2.4 (2a) =	172.75 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.98 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	172.75 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			5.29	$\times 1/[1/(1.2) + 0.04]$	6.06		
Windows Type 2			5.29	$\times 1/[1/(1.2) + 0.04]$	6.06		
Windows Type 3			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 4			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 5			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		
Floor			71.98	0.11	7.9178		
Walls Type1	41.71	17.94	23.77	0.18	4.28		
Walls Type2	11.24	2.1	9.14	0.18	1.65		
Total area of elements, m²			124.93				
Party wall			43.65	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 36.9 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 48.65 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5

 (38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

77.15	77.15	77.15	77.15	77.15	77.15	77.15	77.15	77.15	77.15	77.15	77.15

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

77.15 (39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

1.07 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.29 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

88.66 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
97.53	93.98	90.44	86.89	83.34	79.8	79.8	83.34	86.89	90.44	93.98	97.53

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1063.97 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

144.63	126.5	130.54	113.8	109.2	94.23	87.32	100.2	101.39	118.17	128.99	140.07

Total = Sum(45)₁...₁₂ = 1395.03 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

21.7	18.97	19.58	17.07	16.38	14.13	13.1	15.03	15.21	17.72	19.35	21.01

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03 (52)

Temperature factor from Table 2b

0.6 (53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03 (54)

Enter (50) or (54) in (55)

1.03 (55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

199.91	176.43	185.81	167.3	164.47	147.72	142.59	155.47	154.89	173.44	182.48	195.35

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

199.91	176.43	185.81	167.3	164.47	147.72	142.59	155.47	154.89	173.44	182.48	195.35

Output from water heater (annual) ^{1...12}	2045.87

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

92.31	82	87.62	80.63	80.53	74.13	73.25	77.54	76.51	83.51	85.68	90.8

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

18	15.98	13	9.84	7.36	6.21	6.71	8.72	11.71	14.87	17.35	18.5

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

201.87	203.97	198.69	187.45	173.27	159.93	151.03	148.93	154.21	165.45	179.63	192.97

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73

 (71)

Water heating gains (Table 5)

(72)m=

124.08	122.03	117.77	111.99	108.24	102.95	98.46	104.22	106.26	112.25	119	122.04

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

401.34	399.38	386.86	366.68	346.26	326.49	313.59	319.27	329.58	349.96	373.39	390.9

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)

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North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
East	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(76)
East	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(76)
East	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(76)
East	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(76)
East	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(76)
East	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(76)
East	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(76)
East	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(76)
East	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(76)
East	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(76)
East	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(76)
East	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	66.09	127.6	213.87	329.81	427.83	450.24	423.48	346.58	253.49	151.67	81.91	54.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	467.43	526.98	600.73	696.49	774.09	776.73	737.08	665.85	583.07	501.63	455.3	445.67	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.81	0.61	0.46	0.52	0.8	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.91	20.05	20.3	20.63	20.88	20.98	21	20.99	20.91	20.58	20.18	19.87	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.75	0.53	0.36	0.42	0.72	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.57	18.78	19.14	19.6	19.91	20.01	20.02	20.02	19.96	19.54	18.97	18.52	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.11	19.28	19.6	20.01	20.3	20.4	20.41	20.41	20.34	19.96	19.45	19.06	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.11	19.28	19.6	20.01	20.3	20.4	20.41	20.41	20.34	19.96	19.45	19.06	(93)

8. Space heating requirement

Set $T_{i,m}$ to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, h_m :

(94)m=	0.99	0.99	0.97	0.91	0.77	0.56	0.4	0.46	0.75	0.95	0.99	1	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	465.04	521.66	584.84	637.24	596.34	436.85	292.76	306.5	438.26	477.09	450.58	443.87	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	1142.6	1109.84	1010.98	857.07	663.34	447.24	294.1	309.33	481.42	721.88	952.96	1146.52	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	504.1	395.25	317.05	158.28	49.85	0	0	0	0	182.12	361.71	522.77	

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 2491.14 (98)

Space heating requirement in $kWh/m^2/year$

34.61 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2491.14

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 2615.7 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2045.87

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2148.16 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 47.64 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

46.58 (330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	46.58	(331)
Energy for lighting (calculated in Appendix L)		317.84	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1106.45 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 24.72 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1131.17 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1131.17 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 24.17 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 164.96 (379)
Total CO2, kg/year	sum of (376)...(382) =		1320.3 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		18.34 (384)
EI rating (section 14)			84.88 (385)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-2-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	50.81 (1a) x	2.4 (2a) =	121.94 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.81 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.94 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			4.6	$\frac{1}{1/(1.2) + 0.04}$	5.27		
Windows Type 2			2.76	$\frac{1}{1/(1.2) + 0.04}$	3.16		
Floor			50.81	0.11	5.5891		
Walls Type1	17.04	7.36	9.68	0.18	1.74		
Walls Type2	19.18	2.1	17.08	0.18	3.07		
Total area of elements, m²			87.03				
Party wall			33.09	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 21.35 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.87 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 29.22 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	49.34	49.34	49.34	49.34	49.34	49.34	49.34	49.34	49.34	49.34	49.34	49.34
Average = Sum(39) _{1...12} /12=												49.34 (39)

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Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97		
Average = Sum(40) _{1...12} /12=													0.97	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

1.71

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

74.91

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	82.4	79.4	76.4	73.41	70.41	67.42	67.42	70.41	73.41	76.4	79.4	82.4		
Total = Sum(44) _{1...12} =													898.88	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.19	106.87	110.28	96.15	92.25	79.61	73.77	84.65	85.66	99.83	108.97	118.34		
Total = Sum(45) _{1...12} =													1178.57	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.33	16.03	16.54	14.42	13.84	11.94	11.07	12.7	12.85	14.97	16.35	17.75		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	177.47	156.8	165.56	149.64	147.53	133.1	129.05	139.93	139.16	155.11	162.47	173.61	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	177.47	156.8	165.56	149.64	147.53	133.1	129.05	139.93	139.16	155.11	162.47	173.61	
Output from water heater (annual) _{1...12}												1829.41	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	84.85	75.48	80.89	74.76	74.9	69.26	68.75	72.37	71.28	77.42	79.03	83.57	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.8	12.26	9.97	7.55	5.64	4.76	5.15	6.69	8.98	11.4	13.3	14.18	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	149.34	150.89	146.98	138.67	128.17	118.31	111.72	110.17	114.08	122.39	132.89	142.75	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	(71)

Water heating gains (Table 5)

(72)m=	114.05	112.32	108.72	103.84	100.67	96.2	92.41	97.27	99	104.05	109.76	112.32	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	325.89	324.17	314.38	298.76	283.19	267.98	257.98	262.84	270.76	286.55	304.66	317.96	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
East	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)

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East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	40.07	78.39	129.09	188.27	230.73	236.19	224.87	193.16	150.14	93.01	49.96	32.95	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	365.96	402.55	443.47	487.03	513.92	504.18	482.85	456	420.9	379.56	354.62	350.91	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.92	0.8	0.61	0.45	0.49	0.75	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.12	20.24	20.46	20.72	20.91	20.98	21	21	20.95	20.71	20.36	20.08	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.9	0.75	0.53	0.36	0.4	0.67	0.93	0.99	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.94	19.12	19.43	19.79	20.02	20.1	20.11	20.11	20.07	19.78	19.29	18.89	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.68	19.94	20.25	20.47	20.54	20.55	20.55	20.51	20.24	19.82	19.49	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.53	19.68	19.94	20.25	20.47	20.54	20.55	20.55	20.51	20.24	19.82	19.49	(93)

8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, h_m :

(94)m=	0.99	0.99	0.97	0.9	0.77	0.57	0.4	0.45	0.71	0.93	0.98	0.99	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	362.98	396.59	428.05	440.68	395.73	287.62	194.39	203.71	298.67	352.94	348.78	348.63	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	751.58	729.38	663.37	560.21	432.53	293.14	195.02	204.83	316.38	475.8	627.87	754.26	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	289.12	223.63	175.08	86.06	27.38	0	0	0	0	91.41	200.94	301.79	

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 1395.4 (98)

Space heating requirement in $kWh/m^2/year$

27.46 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
1395.4

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 1465.17 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

1829.41

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 1920.89 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 33.86 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

32.88 (330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	32.88	(331)
Energy for lighting (calculated in Appendix L)		243.69	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 786.44 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 17.57 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 804.01 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		804.01 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 17.06 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 126.47 (379)
Total CO2, kg/year	sum of (376)...(382) =		947.55 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		18.65 (384)
EI rating (section 14)			86.75 (385)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-2-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	74.09 (1a)	2.4 (2a)	177.82 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.09 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	177.82 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	0.85 (20)

Infiltration rate incorporating shelter factor	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			4.6	$\times 1/[1/(1.2) + 0.04]$	5.27		
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 3			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 4			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Floor			74.09	0.11	8.149899		
Walls Type1	31	12.88	18.12	0.18	3.26		
Walls Type2	31.26	2.1	29.16	0.18	5.25		
Total area of elements, m²			136.35				
Party wall			31.88	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 33.93 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 44.89 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=

29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

74.23	74.23	74.23	74.23	74.23	74.23	74.23	74.23	74.23	74.23	74.23	74.23

Average = Sum(39)_{1...12} /12=

74.23

 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1	1	1	1	1	1	1	1	1	1	1	1

Average = Sum(40)_{1...12} /12=

1

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

2.34

 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

89.8

 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

98.78	95.19	91.6	88.01	84.42	80.82	80.82	84.42	88.01	91.6	95.19	98.78

Total = Sum(44)_{1...12} =

1077.64

 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

146.49	128.12	132.21	115.27	110.6	95.44	88.44	101.49	102.7	119.68	130.64	141.87

Total = Sum(45)_{1...12} =

1412.96

 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

21.97	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.4	17.95	19.6	21.28

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

 (48)

Temperature factor from Table 2b

0

 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110

 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

 (52)

Temperature factor from Table 2b

0.6

 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03

 (54)

Enter (50) or (54) in (55)

1.03

 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.77	178.05	187.49	168.76	165.88	148.93	143.72	156.76	156.19	174.96	184.14	197.15

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=	201.77	178.05	187.49	168.76	165.88	148.93	143.72	156.76	156.19	174.96	184.14	197.15

Output from water heater (annual)_{1...12}

2063.8

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.93	82.54	88.18	81.12	81	74.53	73.63	77.97	76.94	84.02	86.23	91.39

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.57	16.49	13.41	10.15	7.59	6.41	6.92	9	12.08	15.34	17.9	19.08

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	206.65	208.79	203.39	191.89	177.36	163.72	154.6	152.45	157.86	169.36	183.88	197.53

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71

(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65

(71)

Water heating gains (Table 5)

(72)m=	124.91	122.83	118.52	112.67	108.87	103.51	98.96	104.79	106.86	112.93	119.77	122.84

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	408.24	406.23	393.44	372.82	351.94	331.75	318.6	324.36	334.92	355.74	379.67	397.57

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
North	0.9x	0.77	x	4.6	x	10.63	x	0.5	x	0.8	=	13.56	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.5	x	0.8	=	25.91	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	4.6	x	34.53	x	0.5	x	0.8	=	44.03	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.5	x	0.8	=	70.72	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.5	x	0.8	=	95.27	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.5	x	0.8	=	101.99	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.5	x	0.8	=	95.22	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.5	x	0.8	=	75.55	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.5	x	0.8	=	52.94	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.5	x	0.8	=	30.84	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.5	x	0.8	=	16.73	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.5	x	0.8	=	11.3	(74)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	58.64	114.1	189.26	282.53	354.84	367.71	348.2	292.85	221.84	135.48	72.93	48.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	466.88	520.33	582.7	655.35	706.78	699.46	666.8	617.21	556.76	491.22	452.6	445.95	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.95	0.84	0.65	0.49	0.54	0.81	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.12	20.35	20.64	20.87	20.98	21	20.99	20.92	20.61	20.24	19.96	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.79	0.57	0.39	0.44	0.74	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.73	18.92	19.25	19.66	19.96	20.07	20.08	20.08	20.02	19.63	19.1	18.68	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.24	19.4	19.69	20.05	20.33	20.43	20.45	20.44	20.38	20.03	19.56	19.19	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.24	19.4	19.69	20.05	20.33	20.43	20.45	20.44	20.38	20.03	19.56	19.19	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.93	0.8	0.6	0.43	0.48	0.76	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	464.78	515.77	569.5	608.68	568.26	421.15	284.13	297.5	425.75	469.06	448.4	444.38	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1108.76	1076.11	978.84	827.77	640.23	432.73	285.53	300.21	466.18	699.74	924.66	1112.73	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	479.13	376.55	304.55	157.74	53.55	0	0	0	0	171.62	342.9	497.25	

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2383.3 (98)

Space heating requirement in kWh/m²/year

32.17 (99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

2383.3

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

2502.46 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2063.8

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2166.99 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

46.69 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

47.94 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

47.94 (331)

Energy for lighting (calculated in Appendix L)

327.88 (332)

12b. CO2 Emissions – Community heating scheme

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%)

If there is CHP using two fuels repeat (363) to (366) for the second fuel

93 (367a)

CO2 associated with heat source 1

[(307b)+(310b)] x 100 ÷ (367b) x

0.22

=

1084.52 (367)

Electrical energy for heat distribution

[(313) x

0.52

=

24.23 (372)

Total CO2 associated with community systems

(363)...(366) + (368)...(372)

=

1108.75 (373)

CO2 associated with space heating (secondary)

(309) x

0

=

0 (374)

CO2 associated with water from immersion heater or instantaneous heater

(312) x

0.22

=

0 (375)

Total CO2 associated with space and water heating

(373) + (374) + (375) =

1108.75 (376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	=	24.88	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	170.17	(379)
Total CO2, kg/year	sum of (376)...(382) =			1303.8	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			17.6	(384)
El rating (section 14)				85.33	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-2-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	75.18 (1a) x	2.4 (2a) =	180.43 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.18 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	180.43 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			5.29	$\times 1/[1/(1.2)+0.04]$	6.06		
Windows Type 2			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 3			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 4			4.6	$\times 1/[1/(1.2)+0.04]$	5.27		
Floor			75.18	0.11	8.2698		
Walls Type1	41.41	15.41	26	0.18	4.68		
Walls Type2	4.86	2.1	2.76	0.18	0.5		
Total area of elements, m²			121.45				
Party wall			42	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 33.61 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.4 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 44.01 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=

29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

73.78	73.78	73.78	73.78	73.78	73.78	73.78	73.78	73.78	73.78	73.78	73.78

Average = Sum(39)_{1...12} /12=

73.78

 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98

Average = Sum(40)_{1...12} /12=

0.98

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

2.37

 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

90.37

 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

99.41	95.79	92.18	88.56	84.95	81.33	81.33	84.95	88.56	92.18	95.79	99.41

Total = Sum(44)_{1...12} =

1084.44

 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

147.42	128.93	133.05	115.99	111.3	96.04	89	102.13	103.35	120.44	131.47	142.77

Total = Sum(45)_{1...12} =

1421.87

 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

22.11	19.34	19.96	17.4	16.69	14.41	13.35	15.32	15.5	18.07	19.72	21.41

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

 (48)

Temperature factor from Table 2b

0

 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110

 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

 (52)

Temperature factor from Table 2b

0.6

 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03

 (54)

Enter (50) or (54) in (55)

1.03

 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

202.69	178.86	188.32	169.49	166.58	149.54	144.27	157.4	156.84	175.72	184.96	198.04

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=

202.69	178.86	188.32	169.49	166.58	149.54	144.27	157.4	156.84	175.72	184.96	198.04

Output from water heater (annual)_{1...12}

2072.71

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=

93.24	82.81	88.46	81.36	81.23	74.73	73.81	78.18	77.16	84.27	86.51	91.69

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

18.64	16.56	13.46	10.19	7.62	6.43	6.95	9.03	12.13	15.4	17.97	19.16

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

209.07	211.24	205.78	194.14	179.44	165.64	156.41	154.24	159.71	171.35	186.04	199.85

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83

(69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6

(71)

Water heating gains (Table 5)

(72)m=

125.32	123.23	118.9	113	109.18	103.79	99.21	105.08	107.16	113.26	120.15	123.24

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

411.51	409.51	396.61	375.81	354.72	334.33	321.05	326.83	337.47	358.48	382.64	400.72

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
East	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(76)
East	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(76)

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East	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(76)
East	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(76)
East	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(76)
East	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(76)
East	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(76)
East	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(76)
East	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(76)
East	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(76)
East	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(76)
East	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)

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South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	159.95	271.13	366.39	444.56	488.08	479.88	464.62	433.09	393.73	298.53	191.37	137.01	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	571.46	680.64	763	820.36	842.8	814.22	785.67	759.92	731.2	657.01	574.01	537.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.88	0.75	0.57	0.41	0.44	0.67	0.91	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.14	20.33	20.56	20.78	20.93	20.99	21	21	20.97	20.78	20.41	20.09	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.85	0.7	0.49	0.33	0.36	0.59	0.88	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.24	19.56	19.86	20.04	20.09	20.1	20.1	20.08	19.86	19.35	18.89	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.67	19.96	20.23	20.4	20.45	20.46	20.46	20.44	20.23	19.77	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.67	19.96	20.23	20.4	20.45	20.46	20.46	20.44	20.23	19.77	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.94	0.86	0.72	0.52	0.36	0.39	0.62	0.88	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	565.34	662.57	715.78	704.73	603.23	426.17	284.12	298.5	453.76	579.7	559.85	533.48	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1116.88	1090.03	993.02	836	641.55	431.63	284.67	299.38	467.52	710.53	934.88	1119.44	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	410.35	287.26	206.27	94.51	28.51	0	0	0	0	97.34	270.02	435.96	

Total per year (kWh/year) = Sum(98)1...5,9...12 = 1830.21 (98)

Space heating requirement in kWh/m²/year

24.34 (99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

1830.21

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

1921.72 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2072.71

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2176.35 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

40.98 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

48.65 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

48.65 (331)

Energy for lighting (calculated in Appendix L)

329.17 (332)

12b. CO2 Emissions – Community heating scheme

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%)

If there is CHP using two fuels repeat (363) to (366) for the second fuel

93 (367a)

CO2 associated with heat source 1

[(307b)+(310b)] x 100 ÷ (367b) x

0.22

= 951.81

(367)

Electrical energy for heat distribution

[(313) x

0.52

= 21.27

(372)

Total CO2 associated with community systems

(363)...(366) + (368)...(372)

= 973.08

(373)

CO2 associated with space heating (secondary)

(309) x

0

= 0

(374)

CO2 associated with water from immersion heater or instantaneous heater

(312) x

0.22

= 0

(375)

Total CO2 associated with space and water heating

(373) + (374) + (375) =

973.08

(376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	=	25.25	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	170.84	(379)
Total CO2, kg/year	sum of (376)...(382) =			1169.17	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.55	(384)
El rating (section 14)				86.96	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-2-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	76.86 (1a) x	2.4 (2a) =	184.46 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76.86 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.46 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) (9)

Additional infiltration [(9)-1]x0.1 = (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 (12)

If no draught lobby, enter 0.05, else enter 0 (13)

Percentage of windows and doors draught stripped (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered (19)

Shelter factor (20) = 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			6.9	$\times 1/[1/(1.2)+0.04]$	7.9		
Windows Type 2			1.84	$\times 1/[1/(1.2)+0.04]$	2.11		
Windows Type 3			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 4			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Floor			76.86	0.11	8.4546		
Walls Type1	31.77	14.26	17.51	0.18	3.15		
Walls Type2	23.59	2.1	21.49	0.18	3.87		
Total area of elements, m²			132.22				
Party wall			33.4	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 34.32 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.54 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 44.86 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=

30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

75.3	75.3	75.3	75.3	75.3	75.3	75.3	75.3	75.3	75.3	75.3	75.3

Average = Sum(39)_{1...12} /12=

75.3

 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98

Average = Sum(40)_{1...12} /12=

0.98

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

2.4

 (42)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

91.21

 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
100.34	96.69	93.04	89.39	85.74	82.09	82.09	85.74	89.39	93.04	96.69	100.34

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)
(44)m=

100.34	96.69	93.04	89.39	85.74	82.09	82.09	85.74	89.39	93.04	96.69	100.34

Total = Sum(44)_{1...12} =

1094.57

 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

148.79	130.14	134.29	117.08	112.34	96.94	89.83	103.08	104.31	121.56	132.7	144.1

Total = Sum(45)_{1...12} =

1435.15

 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

22.32	19.52	20.14	17.56	16.85	14.54	13.47	15.46	15.65	18.23	19.9	21.61

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

 (48)

Temperature factor from Table 2b

0

 (49)

Energy lost from water storage, kWh/year (48) x (49) =

110

 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

 (52)

Temperature factor from Table 2b

0.6

 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) =

1.03

 (54)

Enter (50) or (54) in (55)

1.03

 (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

DER WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

204.07	180.06	189.57	170.57	167.61	150.43	145.1	158.36	157.8	176.84	186.19	199.38

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=

204.07	180.06	189.57	170.57	167.61	150.43	145.1	158.36	157.8	176.84	186.19	199.38

Output from water heater (annual)_{1...12}

2085.99

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=

93.7	83.21	88.87	81.72	81.57	75.03	74.09	78.5	77.48	84.64	86.92	92.13

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

19.01	16.88	13.73	10.39	7.77	6.56	7.09	9.21	12.37	15.7	18.33	19.54

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

212.75	214.96	209.4	197.55	182.6	168.55	159.16	156.96	162.52	174.36	189.31	203.37

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

35	35	35	35	35	35	35	35	35	35	35	35

(69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02

(71)

Water heating gains (Table 5)

(72)m=

125.93	123.83	119.45	113.5	109.64	104.2	99.58	105.5	107.61	113.77	120.72	123.84

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

416.7	414.68	401.59	380.46	359.02	338.32	324.84	330.68	341.5	362.84	387.37	405.75

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
South	0.9x	0.77	x	6.9	x	46.75	x	0.5	x	0.8	=	89.42	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)

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South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	6.9	x	76.57	x	0.5	x	0.8	=	146.45	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	6.9	x	97.53	x	0.5	x	0.8	=	186.55	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	6.9	x	110.23	x	0.5	x	0.8	=	210.84	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	6.9	x	114.87	x	0.5	x	0.8	=	219.71	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	6.9	x	110.55	x	0.5	x	0.8	=	211.44	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	6.9	x	108.01	x	0.5	x	0.8	=	206.59	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	6.9	x	104.89	x	0.5	x	0.8	=	200.63	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	6.9	x	101.89	x	0.5	x	0.8	=	194.87	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	6.9	x	82.59	x	0.5	x	0.8	=	157.96	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	6.9	x	55.42	x	0.5	x	0.8	=	106	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	6.9	x	40.4	x	0.5	x	0.8	=	77.27	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)

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West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	164.06	273.48	359.33	422.01	452.71	440.98	428.65	406.82	381.09	298.15	195.39	141.14	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	580.77	688.16	760.91	802.47	811.73	779.3	753.49	737.5	722.59	660.98	582.76	546.88	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.78	0.6	0.44	0.47	0.68	0.91	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.14	20.32	20.54	20.76	20.92	20.98	21	21	20.97	20.77	20.4	20.09	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.87	0.73	0.52	0.35	0.38	0.61	0.88	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.23	19.54	19.83	20.02	20.09	20.1	20.1	20.08	19.86	19.35	18.89	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.67	19.94	20.21	20.38	20.45	20.46	20.46	20.43	20.22	19.77	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.67	19.94	20.21	20.38	20.45	20.46	20.46	20.43	20.22	19.77	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.94	0.88	0.75	0.56	0.38	0.41	0.64	0.89	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	574.7	670.65	717.67	702.35	605.66	432.9	289.8	304.42	460.95	586.61	568.76	542.66	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1139.75	1111.91	1011.98	851.26	653.69	440.35	290.56	305.57	476.96	724.63	953.92	1142.43	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	420.4	296.53	218.96	107.22	35.74	0	0	0	0	102.68	277.32	446.23	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1905.07 (99)

Space heating requirement in kWh/m²/year

24.79 (99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

1905.07

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

2000.33 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2085.99

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2190.29 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

41.91 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

49.74 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

49.74 (331)

Energy for lighting (calculated in Appendix L)

335.67 (332)

12b. CO2 Emissions – Community heating scheme

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%)

If there is CHP using two fuels repeat (363) to (366) for the second fuel

93 (367a)

CO2 associated with heat source 1

[(307b)+(310b)] x 100 ÷ (367b) x

0.22

= 973.3

(367)

Electrical energy for heat distribution

[(313) x

0.52

= 21.75

(372)

Total CO2 associated with community systems

(363)...(366) + (368)...(372)

= 995.05

(373)

CO2 associated with space heating (secondary)

(309) x

0

= 0

(374)

CO2 associated with water from immersion heater or instantaneous heater (312) x

0.22

= 0

(375)

Total CO2 associated with space and water heating

(373) + (374) + (375) =

995.05

(376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	25.81	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	174.21	(379)
Total CO2, kg/year	sum of (376)...(382) =			1195.08	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.55	(384)
El rating (section 14)				86.86	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-2-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	73.72 (1a) x	2.4 (2a) =	176.93 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.72 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.93 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		(26)
Windows Type 1			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 3			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 4			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 5			4.6	$\times 1/[1/(1.2) + 0.04]$	5.27		(27)
Floor			73.72	0.11	8.1092		(28)
Walls Type1	41.25	15.64	25.61	0.18	4.61		(29)
Walls Type2	32.91	2.1	30.81	0.18	5.55		(29)
Total area of elements, m²			147.88				(31)
Party wall			15.07	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 38.69 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.01 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 49.7 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=	78.89	78.89	78.89	78.89	78.89	78.89	78.89	78.89	78.89	78.89	78.89	78.89	
Average = Sum(39) _{1...12} /12=												78.89	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	
Average = Sum(40) _{1...12} /12=												1.07	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

$$\text{if TFA} > 13.9, N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$$

$$\text{if TFA} \leq 13.9, N = 1$$

	2.33	(42)

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	89.61	(43)

Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	98.57	94.98	91.4	87.82	84.23	80.65	80.65	84.23	87.82	91.4	94.98	98.57	
Total = Sum(44) _{1...12} =												1075.29	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.17	127.84	131.92	115.01	110.36	95.23	88.25	101.26	102.47	119.42	130.36	141.56	
Total = Sum(45) _{1...12} =												1409.88	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.93	19.18	19.79	17.25	16.55	14.28	13.24	15.19	15.37	17.91	19.55	21.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	0	(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):	0	(48)

Temperature factor from Table 2b	0	(49)

Energy lost from water storage, kWh/year	(48) x (49) =	110	(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02	(51)

If community heating see section 4.3

Volume factor from Table 2a	1.03	(52)

Temperature factor from Table 2b	0.6	(53)

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	1.03	(54)

Enter (50) or (54) in (55)	1.03	(55)

Water storage loss calculated for each month $((56)m = (55) \times (41)m$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

201.45	177.77	187.2	168.51	165.64	148.73	143.52	156.54	155.97	174.7	183.85	196.84

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

201.45	177.77	187.2	168.51	165.64	148.73	143.52	156.54	155.97	174.7	183.85	196.84

Output from water heater (annual) ^{1...12}	2060.72

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

92.82	82.45	88.09	81.04	80.92	74.46	73.56	77.89	76.87	83.93	86.14	91.29

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

18.35	16.3	13.25	10.03	7.5	6.33	6.84	8.89	11.94	15.16	17.69	18.86

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

205.82	207.95	202.57	191.12	176.65	163.06	153.98	151.84	157.22	168.68	183.14	196.74

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32

 (71)

Water heating gains (Table 5)

(72)m=

124.76	122.69	118.4	112.55	108.76	103.42	98.88	104.69	106.76	112.81	119.64	122.7

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

406.93	404.94	392.22	371.7	350.9	330.8	317.69	323.42	333.91	354.64	378.47	396.29

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	161.2	273.58	370.43	450.44	495.29	487.26	471.65	439.12	398.42	301.43	192.93	138.04	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	568.13	678.52	762.64	822.13	846.2	818.06	789.34	762.55	732.33	656.07	571.4	534.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.78	0.6	0.44	0.47	0.7	0.92	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.03	20.22	20.47	20.72	20.9	20.98	21	21	20.96	20.72	20.31	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.87	0.72	0.52	0.34	0.37	0.62	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.74	19.02	19.37	19.71	19.93	20.01	20.02	20.02	19.99	19.72	19.15	18.67	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.26	19.5	19.81	20.12	20.32	20.4	20.41	20.41	20.38	20.12	19.62	19.19	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

DER WorkSheet: New dwelling design stage

(93)m=	19.26	19.5	19.81	20.12	20.32	20.4	20.41	20.41	20.38	20.12	19.62	19.19	(93)

8. Space heating requirement

Set $T_{i,m}$ to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, h_m :

(94)m=	0.99	0.97	0.94	0.87	0.74	0.55	0.38	0.41	0.65	0.89	0.98	0.99	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	562.06	661.28	718.83	716.24	624.48	448.19	299.74	314.82	473.54	585.86	557.91	530.05	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	1179.95	1151.97	1049.98	884.93	680.16	457.56	300.84	316.53	495.37	751.16	987.46	1182.59	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	459.71	329.74	246.37	121.46	41.43	0	0	0	0	122.98	309.28	485.49	

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 2116.46 (98)

Space heating requirement in $kWh/m^2/year$

28.71 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2116.46

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 2222.29 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2060.72

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2163.75 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 43.86 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

47.7 (330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	47.7	(331)
Energy for lighting (calculated in Appendix L)		324.05	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1018.69 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 22.76 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1041.46 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1041.46 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 24.76 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 168.18 (379)
Total CO2, kg/year	sum of (376)...(382) =		1234.4 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		16.74 (384)
EI rating (section 14)			86.07 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-2-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	70.77 (1a) x	2.4 (2a) =	169.85 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.77 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	169.85 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		(26)
Windows Type 1			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		(27)
Windows Type 2			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		(27)
Windows Type 3			4.6	$\times 1/[1/(1.2) + 0.04]$	5.27		(27)
Windows Type 4			5.29	$\times 1/[1/(1.2) + 0.04]$	6.06		(27)
Windows Type 5			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Floor			70.77	0.11	7.784699		(28)
Walls Type1	35.57	16.33	19.24	0.18	3.46		(29)
Walls Type2	47.73	2.1	45.63	0.18	8.21		(29)
Total area of elements, m²			154.07				(31)
Party wall			15.1	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 40.68 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.52 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 53.2 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
28.02	28.02	28.02	28.02	28.02	28.02	28.02	28.02	28.02	28.02	28.02	28.02

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

81.23	81.23	81.23	81.23	81.23	81.23	81.23	81.23	81.23	81.23	81.23	81.23

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

81.23

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

1.15

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.26

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

87.99

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

96.78	93.27	89.75	86.23	82.71	79.19	79.19	82.71	86.23	89.75	93.27	96.78

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1055.83

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

143.53	125.53	129.54	112.93	108.36	93.51	86.65	99.43	100.62	117.26	128	139

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1384.36

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

21.53	18.83	19.43	16.94	16.25	14.03	13	14.91	15.09	17.59	19.2	20.85

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

198.81	175.46	184.81	166.43	163.64	147	141.93	154.71	154.11	172.54	181.49	194.28

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

198.81	175.46	184.81	166.43	163.64	147	141.93	154.71	154.11	172.54	181.49	194.28

Output from water heater (annual) ^{1...12}	2035.2

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

91.94	81.68	87.29	80.35	80.25	73.89	73.03	77.28	76.25	83.21	85.36	90.44

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23	113.23

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

17.75	15.76	12.82	9.71	7.26	6.13	6.62	8.6	11.55	14.66	17.11	18.24

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

199.09	201.15	195.95	184.86	170.87	157.73	148.94	146.88	152.08	163.16	177.15	190.3

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59	-90.59

 (71)

Water heating gains (Table 5)

(72)m=

123.58	121.55	117.33	111.59	107.87	102.62	98.16	103.87	105.9	111.84	118.55	121.56

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

397.39	395.44	383.07	363.13	342.96	323.44	310.69	316.32	326.5	346.64	369.79	387.07

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	4.6	x	10.63	x	0.5	x	0.8	=	13.56	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.5	x	0.8	=	25.91	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	4.6	x	34.53	x	0.5	x	0.8	=	44.03	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.5	x	0.8	=	70.72	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.5	x	0.8	=	95.27	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.5	x	0.8	=	101.99	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.5	x	0.8	=	95.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.5	x	0.8	=	75.55	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.5	x	0.8	=	52.94	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.5	x	0.8	=	30.84	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.5	x	0.8	=	16.73	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.5	x	0.8	=	11.3	(74)
West	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(80)

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West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	68.23	132.37	220.45	333.22	423.85	441.92	417.35	347.25	259.5	157.25	84.75	56.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	465.62	527.81	603.51	696.35	766.82	765.36	728.04	663.57	586	503.89	454.54	443.46	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.83	0.64	0.48	0.55	0.82	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.82	19.96	20.22	20.57	20.84	20.97	20.99	20.99	20.89	20.53	20.1	19.78	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.77	0.55	0.37	0.43	0.74	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.39	18.6	18.98	19.46	19.81	19.94	19.96	19.96	19.88	19.42	18.81	18.33	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.96	19.14	19.48	19.9	20.22	20.35	20.37	20.37	20.28	19.86	19.32	18.91	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.96	19.14	19.48	19.9	20.22	20.35	20.37	20.37	20.28	19.86	19.32	18.91	(93)

8. Space heating requirement

Set $T_{i,m}$ to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, h_m :

(94)m=	0.99	0.99	0.97	0.92	0.79	0.59	0.42	0.48	0.76	0.95	0.99	1	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	463.1	522.24	587.39	640.08	604.93	451.09	304.18	317.98	447.66	479.59	449.67	441.56	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	1190.8	1157.04	1054.23	893.73	692.28	467.05	306.47	322.42	502.14	752.26	992.95	1194.81	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	541.41	426.59	347.33	182.63	64.99	0	0	0	0	202.87	391.16	560.42	

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 2717.39 (98)

Space heating requirement in $kWh/m^2/year$

38.4 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2717.39

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 2853.26 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2035.2

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2136.96 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 49.9 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

45.79 (330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	45.79	(331)
Energy for lighting (calculated in Appendix L)		313.45	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1159.02 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 25.9 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1184.92 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1184.92 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 23.77 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 162.68 (379)
Total CO2, kg/year	sum of (376)...(382) =		1371.37 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		19.38 (384)
EI rating (section 14)			84.13 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-2-08

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	73.39 (1a)	2.4 (2a)	176.14 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.39 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	176.14 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		(26)
Windows Type 1			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 3			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 4			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		(27)
Windows Type 5			6.9	$\times 1/[1/(1.2) + 0.04]$	7.9		(27)
Floor			73.39	0.11	8.0729		(28)
Walls Type1	40.92	17.94	22.98	0.18	4.14		(29)
Walls Type2	21.61	2.1	19.51	0.18	3.51		(29)
Total area of elements, m²			135.92				(31)
Party wall			38.59	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 38.78 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.54 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 51.33 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

80.39	80.39	80.39	80.39	80.39	80.39	80.39	80.39	80.39	80.39	80.39	80.39

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

80.39

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

1.1

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.33

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d, \text{average}} = (25 \times N) + 36$

89.43

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

98.37	94.8	91.22	87.64	84.07	80.49	80.49	84.07	87.64	91.22	94.8	98.37

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1073.18

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

145.89	127.59	131.67	114.79	110.14	95.04	88.07	101.06	102.27	119.19	130.1	141.28

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1407.11

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

21.88	19.14	19.75	17.22	16.52	14.26	13.21	15.16	15.34	17.88	19.52	21.19

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

201.16	177.52	186.94	168.28	165.42	148.54	143.35	156.34	155.77	174.46	183.6	196.56

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

201.16	177.52	186.94	168.28	165.42	148.54	143.35	156.34	155.77	174.46	183.6	196.56

Output from water heater (annual) ^{1...12}	2057.94

 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

(65)m=

92.73	82.37	88	80.96	80.84	74.4	73.51	77.83	76.8	83.85	86.05	91.2

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

18.28	16.24	13.21	10	7.47	6.31	6.82	8.86	11.89	15.1	17.63	18.79

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

205.08	207.2	201.84	190.43	176.01	162.47	153.42	151.29	156.66	168.07	182.48	196.03

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02

 (71)

Water heating gains (Table 5)

(72)m=

124.64	122.57	118.28	112.45	108.66	103.33	98.8	104.6	106.67	112.7	119.52	122.58

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

405.88	403.9	391.21	370.75	350.03	329.99	316.92	322.64	333.1	353.76	377.51	395.28

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	6.9	x	19.64	x	0.5	x	0.8	=	37.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	6.9	x	38.42	x	0.5	x	0.8	=	73.49	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	6.9	x	63.27	x	0.5	x	0.8	=	121.02	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	6.9	x	92.28	x	0.5	x	0.8	=	176.5	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	6.9	x	113.09	x	0.5	x	0.8	=	216.31	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)

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West	0.9x	0.77	x	6.9	x	115.77	x	0.5	x	0.8	=	221.43	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	6.9	x	110.22	x	0.5	x	0.8	=	210.81	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	6.9	x	94.68	x	0.5	x	0.8	=	181.08	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	6.9	x	73.59	x	0.5	x	0.8	=	140.75	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	6.9	x	45.59	x	0.5	x	0.8	=	87.2	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	6.9	x	24.49	x	0.5	x	0.8	=	46.84	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	6.9	x	16.15	x	0.5	x	0.8	=	30.89	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	83.89	163.37	270.67	402.57	503.68	520.97	493.73	416.61	316.88	193.97	104.38	69.17	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	489.77	567.26	661.89	773.33	853.72	850.96	810.65	739.25	649.98	547.73	481.9	464.45	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.78	0.59	0.43	0.49	0.77	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.9	20.05	20.33	20.66	20.89	20.98	21	20.99	20.93	20.6	20.17	19.85	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20	20	20	20	20	20	20	20	20	20	20	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.89	0.72	0.5	0.34	0.39	0.69	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.54	18.77	19.16	19.62	19.91	19.99	20	20	19.95	19.55	18.94	18.48	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.08	19.28	19.63	20.04	20.3	20.39	20.4	20.4	20.34	19.97	19.44	19.03	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.08	19.28	19.63	20.04	20.3	20.39	20.4	20.4	20.34	19.97	19.44	19.03	(93)

8. Space heating requirement

Set $T_{i,m}$ to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, h_m :

(94)m=	0.99	0.99	0.97	0.89	0.74	0.54	0.38	0.43	0.72	0.94	0.99	1	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	486.95	560.19	639.11	691.43	631.73	456.06	304.38	319.11	464.76	514.94	476.13	462.39	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	1188.25	1156.28	1055.52	895.37	691.5	465.26	305.54	321.46	501.7	753.16	991.7	1191.93	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	521.76	400.57	309.81	146.83	44.47	0	0	0	0	177.24	371.21	542.78	

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 2514.67 (98)

Space heating requirement in $kWh/m^2/year$

34.26 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2514.67

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 2640.4 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2057.94

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2160.84 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 48.01 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

47.49 (330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	47.49	(331)
Energy for lighting (calculated in Appendix L)		322.88	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1115.13 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 24.92 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1140.05 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1140.05 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 24.65 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 167.57 (379)
Total CO2, kg/year	sum of (376)...(382) =		1332.27 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		18.15 (384)
EI rating (section 14)			84.92 (385)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-3-01

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	71.98 (1a) x	2.4 (2a) =	172.75 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.98 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	172.75 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)

Additional infiltration [(9)-1]x0.1 = (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 (12)

If no draught lobby, enter 0.05, else enter 0 (13)

Percentage of windows and doors draught stripped (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered (19)

Shelter factor (20) = 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			5.29	$\times 1/[1/(1.2) + 0.04]$	6.06		
Windows Type 2			5.29	$\times 1/[1/(1.2) + 0.04]$	6.06		
Windows Type 3			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 4			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 5			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		
Walls Type1	41.71	17.94	23.77	0.18	4.28		
Walls Type2	11.24	2.1	9.14	0.18	1.65		
Total area of elements, m²			52.95				
Party wall			43.65	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 28.99 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.3 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 36.29 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=

28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

64.79	64.79	64.79	64.79	64.79	64.79	64.79	64.79	64.79	64.79	64.79	64.79

Average = Sum(39)_{1...12} /12=

64.79 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9

Average = Sum(40)_{1...12} /12=

0.9 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

2.29 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

88.66 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

97.53	93.98	90.44	86.89	83.34	79.8	79.8	83.34	86.89	90.44	93.98	97.53

Total = Sum(44)_{1...12} =

1063.97 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

144.63	126.5	130.54	113.8	109.2	94.23	87.32	100.2	101.39	118.17	128.99	140.07

Total = Sum(45)_{1...12} =

1395.03 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

21.7	18.97	19.58	17.07	16.38	14.13	13.1	15.03	15.21	17.72	19.35	21.01

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03 (52)

Temperature factor from Table 2b

0.6 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03 (54)

Enter (50) or (54) in (55)

1.03 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

199.91	176.43	185.81	167.3	164.47	147.72	142.59	155.47	154.89	173.44	182.48	195.35

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=

199.91	176.43	185.81	167.3	164.47	147.72	142.59	155.47	154.89	173.44	182.48	195.35

Output from water heater (annual)_{1...12}

2045.87

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=

92.31	82	87.62	80.63	80.53	74.13	73.25	77.54	76.51	83.51	85.68	90.8

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66	114.66

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

18	15.98	13	9.84	7.36	6.21	6.71	8.72	11.71	14.87	17.35	18.5

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

201.87	203.97	198.69	187.45	173.27	159.93	151.03	148.93	154.21	165.45	179.63	192.97

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47

(69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73	-91.73

(71)

Water heating gains (Table 5)

(72)m=

124.08	122.03	117.77	111.99	108.24	102.95	98.46	104.22	106.26	112.25	119	122.04

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

401.34	399.38	386.86	366.68	346.26	326.49	313.59	319.27	329.58	349.96	373.39	390.9

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
North	0.9x	0.77	x	5.29	x	10.63	x	0.5	x	0.8	=	15.59	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)

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North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	5.29	x	20.32	x	0.5	x	0.8	=	29.8	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	5.29	x	34.53	x	0.5	x	0.8	=	50.63	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	5.29	x	55.46	x	0.5	x	0.8	=	81.33	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	5.29	x	74.72	x	0.5	x	0.8	=	109.56	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	5.29	x	79.99	x	0.5	x	0.8	=	117.29	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	5.29	x	74.68	x	0.5	x	0.8	=	109.5	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	5.29	x	59.25	x	0.5	x	0.8	=	86.88	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	5.29	x	41.52	x	0.5	x	0.8	=	60.88	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	5.29	x	24.19	x	0.5	x	0.8	=	35.47	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	5.29	x	13.12	x	0.5	x	0.8	=	19.24	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)

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North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	5.29	x	8.86	x	0.5	x	0.8	=	13	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
East	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(76)
East	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(76)
East	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(76)
East	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(76)
East	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(76)
East	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(76)
East	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(76)
East	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(76)
East	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(76)
East	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(76)
East	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(76)
East	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	66.09	127.6	213.87	329.81	427.83	450.24	423.48	346.58	253.49	151.67	81.91	54.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	467.43	526.98	600.73	696.49	774.09	776.73	737.08	665.85	583.07	501.63	455.3	445.67	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	1	0.99	0.98	0.91	0.73	0.53	0.39	0.45	0.73	0.95	0.99	1	

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.29	20.52	20.79	20.95	20.99	21	21	20.97	20.73	20.39	20.12	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	20.17	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.46	0.31	0.37	0.65	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.23	19.56	19.93	20.13	20.16	20.17	20.17	20.14	19.86	19.37	18.99	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.65	19.94	20.28	20.46	20.5	20.5	20.5	20.47	20.21	19.78	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.65	19.94	20.28	20.46	20.5	20.5	20.5	20.47	20.21	19.78	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.97	0.88	0.7	0.49	0.34	0.4	0.68	0.93	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	464.89	520.79	580.26	615.08	542.13	379.51	252.45	265.04	397.09	468.78	449.81	443.82	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	984.02	955.96	870.94	737.02	567.33	382.01	252.68	265.6	412.9	622.71	821.5	987.36	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	386.24	292.43	216.27	87.8	18.75	0	0	0	0	114.52	267.62	404.4	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1788.02 (98)

Space heating requirement in kWh/m²/year

24.84 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers 1 (303a)

Fraction of total space heat from Community boilers (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating

Annual space heating requirement kWh/year 1788.02

Space heat from Community boilers (98) x (304a) x (305) x (306) = 1877.42 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308)

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 2045.87

If DHW from community scheme:

Water heat from Community boilers (64) x (303a) x (305) x (306) = 2148.16 (310a)

Electricity used for heat distribution 0.01 x [(307a)...(307e) + (310a)...(310e)] = 40.26 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside 46.58 (330a)

warm air heating system fans 0 (330b)

pump for solar water heating 0 (330g)

Total electricity for the above, kWh/year =(330a) + (330b) + (330g) = 46.58 (331)

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Energy for lighting (calculated in Appendix L)

317.84 (332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 934.97 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 20.89 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 955.87 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		955.87 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 24.17 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 164.96 (379)
Total CO2, kg/year	sum of (376)...(382) =		1145 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		15.91 (384)
El rating (section 14)			86.88 (385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-3-02

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	50.81 (1a) x	2.4 (2a) =	121.94 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.81 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	121.94 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			4.6	$\times 1/[1/(1.2) + 0.04]$	5.27		
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Walls Type1	17.04	7.36	9.68	0.18	1.74		
Walls Type2	19.18	2.1	17.08	0.18	3.07		
Total area of elements, m²			36.22				
Party wall			33.09	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 15.76 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.64 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 20.4 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12	20.12

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 40.52 40.52 40.52 40.52 40.52 40.52 40.52 40.52 40.52 40.52 40.52 40.52
Average = Sum(39)_{1...12} /12= 40.52 (39)

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Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8		
Average = Sum(40) _{1...12} /12=													0.8	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

1.71

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

74.91

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	82.4	79.4	76.4	73.41	70.41	67.42	67.42	70.41	73.41	76.4	79.4	82.4		
Total = Sum(44) _{1...12} =													898.88	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.19	106.87	110.28	96.15	92.25	79.61	73.77	84.65	85.66	99.83	108.97	118.34		
Total = Sum(45) _{1...12} =													1178.57	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.33	16.03	16.54	14.42	13.84	11.94	11.07	12.7	12.85	14.97	16.35	17.75		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	177.47	156.8	165.56	149.64	147.53	133.1	129.05	139.93	139.16	155.11	162.47	173.61	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	177.47	156.8	165.56	149.64	147.53	133.1	129.05	139.93	139.16	155.11	162.47	173.61	
Output from water heater (annual) _{1...12}												1829.41	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	84.85	75.48	80.89	74.76	74.9	69.26	68.75	72.37	71.28	77.42	79.03	83.57	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.8	12.26	9.97	7.55	5.64	4.76	5.15	6.69	8.98	11.4	13.3	14.18	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	149.34	150.89	146.98	138.67	128.17	118.31	111.72	110.17	114.08	122.39	132.89	142.75	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	(71)

Water heating gains (Table 5)

(72)m=	114.05	112.32	108.72	103.84	100.67	96.2	92.41	97.27	99	104.05	109.76	112.32	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	325.89	324.17	314.38	298.76	283.19	267.98	257.98	262.84	270.76	286.55	304.66	317.96	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
East	0.9x	0.77	x	4.6	x	19.64	x	0.5	x	0.8	=	25.04	(76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	4.6	x	38.42	x	0.5	x	0.8	=	48.99	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	4.6	x	63.27	x	0.5	x	0.8	=	80.68	(76)

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East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	4.6	x	92.28	x	0.5	x	0.8	=	117.67	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	4.6	x	113.09	x	0.5	x	0.8	=	144.21	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	4.6	x	115.77	x	0.5	x	0.8	=	147.62	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	4.6	x	110.22	x	0.5	x	0.8	=	140.54	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	4.6	x	94.68	x	0.5	x	0.8	=	120.72	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	4.6	x	73.59	x	0.5	x	0.8	=	93.84	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	4.6	x	45.59	x	0.5	x	0.8	=	58.13	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	4.6	x	24.49	x	0.5	x	0.8	=	31.23	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	4.6	x	16.15	x	0.5	x	0.8	=	20.59	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	40.07	78.39	129.09	188.27	230.73	236.19	224.87	193.16	150.14	93.01	49.96	32.95	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	365.96	402.55	443.47	487.03	513.92	504.18	482.85	456	420.9	379.56	354.62	350.91	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.87	0.71	0.51	0.37	0.41	0.65	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.38	20.49	20.68	20.87	20.97	21	21	21	20.99	20.85	20.58	20.34	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.85	0.66	0.45	0.31	0.34	0.59	0.88	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.43	19.6	19.86	20.12	20.23	20.25	20.26	20.26	20.25	20.1	19.72	19.38	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.91	20.05	20.27	20.49	20.6	20.63	20.63	20.63	20.62	20.47	20.15	19.86	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.91	20.05	20.27	20.49	20.6	20.63	20.63	20.63	20.62	20.47	20.15	19.86	(93)

8. Space heating requirement

Set $T_{i,m}$ to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, h_m :

(94)m=	0.99	0.98	0.95	0.86	0.68	0.48	0.34	0.38	0.62	0.89	0.98	0.99	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	362.18	394.4	420.6	416.74	350.43	243.26	163.14	171.17	259.87	339.19	346.55	348.11	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	632.45	613.77	557.97	469.84	360.76	244.17	163.21	171.31	264.11	400.09	528.68	634.7	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	201.08	147.41	102.21	38.23	7.68	0	0	0	0	45.31	131.13	213.23	

Total per year ($kWh/year$) = $Sum(98)_{1..12} =$ 886.29 (98)

Space heating requirement in $kWh/m^2/year$

17.44 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
886.29

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 930.6 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

1829.41

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 1920.89 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 28.51 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

32.88 (330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	32.88	(331)
Energy for lighting (calculated in Appendix L)		243.69	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 662.28 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 14.8 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 677.08 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		677.08 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 17.06 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 126.47 (379)
Total CO2, kg/year	sum of (376)...(382) =		820.62 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		16.15 (384)
EI rating (section 14)			88.52 (385)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-3-03

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	74.09 (1a) x	2.4 (2a) =	177.82 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.09 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	177.82 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)

Additional infiltration [(9)-1]x0.1 = (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 (12)

If no draught lobby, enter 0.05, else enter 0 (13)

Percentage of windows and doors draught stripped (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered (19)

Shelter factor (20) = 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			4.6	$\times 1/[1/(1.2) + 0.04]$	5.27		
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 3			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 4			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Walls Type1	31	12.88	18.12	0.18	3.26		
Walls Type2	31.26	2.1	29.16	0.18	5.25		
Total area of elements, m²			62.26				
Party wall			31.88	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 25.78 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.98 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 32.75 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34	29.34

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 62.09 62.09 62.09 62.09 62.09 62.09 62.09 62.09 62.09 62.09 62.09 62.09 (39)

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Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84		
Average = Sum(40) _{1...12} /12=													0.84	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.34

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

89.8

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	98.78	95.19	91.6	88.01	84.42	80.82	80.82	84.42	88.01	91.6	95.19	98.78		
Total = Sum(44) _{1...12} =													1077.64	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.49	128.12	132.21	115.27	110.6	95.44	88.44	101.49	102.7	119.68	130.64	141.87		
Total = Sum(45) _{1...12} =													1412.96	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.97	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.4	17.95	19.6	21.28		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.77	178.05	187.49	168.76	165.88	148.93	143.72	156.76	156.19	174.96	184.14	197.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.77	178.05	187.49	168.76	165.88	148.93	143.72	156.76	156.19	174.96	184.14	197.15	
Output from water heater (annual) _{1...12}												2063.8	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	92.93	82.54	88.18	81.12	81	74.53	73.63	77.97	76.94	84.02	86.23	91.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	117.06	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.57	16.49	13.41	10.15	7.59	6.41	6.92	9	12.08	15.34	17.9	19.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	206.65	208.79	203.39	191.89	177.36	163.72	154.6	152.45	157.86	169.36	183.88	197.53	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	-93.65	(71)

Water heating gains (Table 5)

(72)m=	124.91	122.83	118.52	112.67	108.87	103.51	98.96	104.79	106.86	112.93	119.77	122.84	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	408.24	406.23	393.44	372.82	351.94	331.75	318.6	324.36	334.92	355.74	379.67	397.57	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.6	x	10.63	x	0.5	x	0.8	=	13.56	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.5	x	0.8	=	25.91	(74)
North	0.9x	0.77	x	4.6	x	34.53	x	0.5	x	0.8	=	44.03	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.5	x	0.8	=	70.72	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.5	x	0.8	=	95.27	(74)

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North	0.9x	0.77	x	4.6	x	79.99	x	0.5	x	0.8	=	101.99	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.5	x	0.8	=	95.22	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.5	x	0.8	=	75.55	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.5	x	0.8	=	52.94	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.5	x	0.8	=	30.84	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.5	x	0.8	=	16.73	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.5	x	0.8	=	11.3	(74)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(76)
East	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(76)

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East $0.9 \times \boxed{0.77} \times \boxed{2.76} \times \boxed{16.15} \times \boxed{0.5} \times \boxed{0.8} = \boxed{12.36}$ (76)

East $0.9 \times \boxed{0.77} \times \boxed{2.76} \times \boxed{16.15} \times \boxed{0.5} \times \boxed{0.8} = \boxed{12.36}$ (76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	58.64	114.1	189.26	282.53	354.84	367.71	348.2	292.85	221.84	135.48	72.93	48.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	466.88	520.33	582.7	655.35	706.78	699.46	666.8	617.21	556.76	491.22	452.6	445.95	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) $\boxed{21}$ (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.77	0.56	0.41	0.46	0.73	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.35	20.56	20.8	20.95	20.99	21	21	20.97	20.76	20.44	20.2	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.72	0.5	0.34	0.38	0.66	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.19	19.36	19.66	19.99	20.18	20.22	20.22	20.22	20.2	19.95	19.5	19.14	(90)

fLA = Living area ÷ (4) = $\boxed{0.4}$ (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.61	19.76	20.02	20.31	20.49	20.53	20.53	20.53	20.51	20.27	19.88	19.56	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.61	19.76	20.02	20.31	20.49	20.53	20.53	20.53	20.51	20.27	19.88	19.56	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.73	0.52	0.37	0.41	0.69	0.94	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	464.57	514.85	565.09	588.85	518.76	365.41	243.93	256.05	384.14	460.34	447.54	444.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	950.45	922.6	839.35	708.79	545.56	368.07	244.15	256.53	397.93	600.72	793.37	953.82	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	361.5	274.01	204.04	86.35	19.94	0	0	0	0	104.44	249	379.1	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = $\boxed{1678.39}$ (98)

Space heating requirement in kWh/m²/year $\boxed{22.65}$ (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

DER WorkSheet: New dwelling design stage

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)
<i>The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.</i>			
Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		kWh/year	
Annual space heating requirement		1678.39	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1762.31	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2063.8	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2166.99	(310a)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	39.29	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		47.94	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	47.94	(331)
Energy for lighting (calculated in Appendix L)		327.88	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	= 912.61 (367)
Electrical energy for heat distribution	[(313) x	0.52	= 20.39 (372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)		= 933 (373)
CO2 associated with space heating (secondary)	(309) x	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	= 0 (375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		933 (376)
CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	= 24.88 (378)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for lighting	(332))) x	0.52	=	170.17	(379)
Total CO2, kg/year	sum of (376)...(382) =			1128.05	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.23	(384)
El rating (section 14)				87.31	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-3-04

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	75.18 (1a) x	2.4 (2a) =	180.43 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.18 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	180.43 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)

Additional infiltration [(9)-1]x0.1 = (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 (12)

If no draught lobby, enter 0.05, else enter 0 (13)

Percentage of windows and doors draught stripped (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered (19)

Shelter factor (20) = 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			5.29	$\times 1/[1/(1.2) + 0.04]$	6.06		
Windows Type 2			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 3			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 4			4.6	$\times 1/[1/(1.2) + 0.04]$	5.27		
Walls Type1	41.41	15.41	26	0.18	4.68		
Walls Type2	4.86	2.1	2.76	0.18	0.5		
Total area of elements, m²			46.27				
Party wall			42	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 25.34 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.33 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 31.67 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	61.44	61.44	61.44	61.44	61.44	61.44	61.44	61.44	61.44	61.44	61.44	61.44

Stroma FSAP 2012 Version: 1.0.4.12 (SAP 9.92) - <http://www.stroma.com> Average = Sum(39)_{1...12} /12= 61.44 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82		
Average = Sum(40) _{1...12} /12=													0.82	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.37

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

90.37

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	99.41	95.79	92.18	88.56	84.95	81.33	81.33	84.95	88.56	92.18	95.79	99.41		
Total = Sum(44) _{1...12} =													1084.44	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.42	128.93	133.05	115.99	111.3	96.04	89	102.13	103.35	120.44	131.47	142.77		
Total = Sum(45) _{1...12} =													1421.87	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.11	19.34	19.96	17.4	16.69	14.41	13.35	15.32	15.5	18.07	19.72	21.41		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.69	178.86	188.32	169.49	166.58	149.54	144.27	157.4	156.84	175.72	184.96	198.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.69	178.86	188.32	169.49	166.58	149.54	144.27	157.4	156.84	175.72	184.96	198.04	
Output from water heater (annual) _{1...12}												2072.71	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	93.24	82.81	88.46	81.36	81.23	74.73	73.81	78.18	77.16	84.27	86.51	91.69	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	118.25	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.64	16.56	13.46	10.19	7.62	6.43	6.95	9.03	12.13	15.4	17.97	19.16	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	209.07	211.24	205.78	194.14	179.44	165.64	156.41	154.24	159.71	171.35	186.04	199.85	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	34.83	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	-94.6	(71)

Water heating gains (Table 5)

(72)m=	125.32	123.23	118.9	113	109.18	103.79	99.21	105.08	107.16	113.26	120.15	123.24	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.51	409.51	396.61	375.81	354.72	334.33	321.05	326.83	337.47	358.48	382.64	400.72	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d			Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(76)
East	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(76)
East	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(76)
East	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(76)
East	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(76)

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East	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(76)
East	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(76)
East	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(76)
East	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(76)
East	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(76)
East	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(76)
East	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(76)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)

DER WorkSheet: New dwelling design stage

South $0.9 \times \boxed{0.77} \times \boxed{2.76} \times \boxed{40.4} \times \boxed{0.5} \times \boxed{0.8} = \boxed{30.91}$ (78)

South $0.9 \times \boxed{0.77} \times \boxed{4.6} \times \boxed{40.4} \times \boxed{0.5} \times \boxed{0.8} = \boxed{51.51}$ (78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=

159.95	271.13	366.39	444.56	488.08	479.88	464.62	433.09	393.73	298.53	191.37	137.01

 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=

571.46	680.64	763	820.36	842.8	814.22	785.67	759.92	731.2	657.01	574.01	537.73

 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.97	0.93	0.82	0.66	0.48	0.34	0.37	0.57	0.86	0.98	0.99

 (86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=

20.39	20.56	20.76	20.91	20.98	21	21	21	20.99	20.9	20.61	20.34

 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=

20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24

 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=

0.99	0.97	0.91	0.79	0.61	0.42	0.28	0.31	0.51	0.82	0.97	0.99

 (89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=

19.43	19.68	19.95	20.14	20.22	20.24	20.24	20.24	20.23	20.13	19.75	19.36

 (90)

fLA = Living area ÷ (4) =

0.4

 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=

19.81	20.04	20.27	20.45	20.53	20.54	20.54	20.54	20.54	20.44	20.09	19.75

 (92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=

19.81	20.04	20.27	20.45	20.53	20.54	20.54	20.54	20.54	20.44	20.09	19.75

 (93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=

0.99	0.96	0.91	0.8	0.63	0.45	0.31	0.33	0.54	0.83	0.97	0.99

 (94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=

563.75	655.55	694.22	655.29	531.65	364.09	242.2	254.43	392.51	545.8	554.55	532.57

 (95)

Monthly average external temperature from Table 8

(96)m=

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2

 (96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=

953.23	929.97	846.02	709.6	542.25	365.06	242.26	254.55	395.56	604.62	798.3	955.43

 (97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=

289.77	184.41	112.94	39.1	7.88	0	0	0	0	43.76	175.49	314.61

 (98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

1167.97

 (98)

Space heating requirement in kWh/m²/year

15.54

 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

DER WorkSheet: New dwelling design stage

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)
<i>The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.</i>			
Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		kWh/year	
Annual space heating requirement		1167.97	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1226.37	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2072.71	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2176.35	(310a)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	34.03	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		48.65	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	48.65	(331)
Energy for lighting (calculated in Appendix L)		329.17	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	= 790.31 (367)
Electrical energy for heat distribution	[(313) x	0.52	= 17.66 (372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)		= 807.97 (373)
CO2 associated with space heating (secondary)	(309) x	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	= 0 (375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		807.97 (376)
CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	= 25.25 (378)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for lighting	(332))) x	0.52	=	170.84	(379)
Total CO2, kg/year	sum of (376)...(382) =			1004.06	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			13.36	(384)
El rating (section 14)				88.8	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-3-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	76.86 (1a) x	2.4 (2a) =	184.46 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76.86 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.46 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) (9)

Additional infiltration [(9)-1]x0.1 = (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 (12)

If no draught lobby, enter 0.05, else enter 0 (13)

Percentage of windows and doors draught stripped (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered (19)

Shelter factor (20) = 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			6.9	$\times 1/[1/(1.2) + 0.04]$	7.9		
Windows Type 2			1.84	$\times 1/[1/(1.2) + 0.04]$	2.11		
Windows Type 3			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Windows Type 4			2.76	$\times 1/[1/(1.2) + 0.04]$	3.16		
Walls Type1	31.77	14.26	17.51	0.18	3.15		
Walls Type2	23.59	2.1	21.49	0.18	3.87		
Total area of elements, m²			55.36				
Party wall			33.4	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 25.87 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.66 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 32.53 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 62.96 62.96 62.96 62.96 62.96 62.96 62.96 62.96 62.96 62.96 62.96 62.96

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82		
Average = Sum(40) _{1...12} /12=													0.82	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.4

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

91.21

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	100.34	96.69	93.04	89.39	85.74	82.09	82.09	85.74	89.39	93.04	96.69	100.34		
Total = Sum(44) _{1...12} =													1094.57	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	148.79	130.14	134.29	117.08	112.34	96.94	89.83	103.08	104.31	121.56	132.7	144.1		
Total = Sum(45) _{1...12} =													1435.15	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.32	19.52	20.14	17.56	16.85	14.54	13.47	15.46	15.65	18.23	19.9	21.61		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	204.07	180.06	189.57	170.57	167.61	150.43	145.1	158.36	157.8	176.84	186.19	199.38	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	204.07	180.06	189.57	170.57	167.61	150.43	145.1	158.36	157.8	176.84	186.19	199.38	
Output from water heater (annual) _{1...12}												2085.99	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	93.7	83.21	88.87	81.72	81.57	75.03	74.09	78.5	77.48	84.64	86.92	92.13	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.01	16.88	13.73	10.39	7.77	6.56	7.09	9.21	12.37	15.7	18.33	19.54	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	212.75	214.96	209.4	197.55	182.6	168.55	159.16	156.96	162.52	174.36	189.31	203.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35	35	35	35	35	35	35	35	35	35	35	35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	(71)

Water heating gains (Table 5)

(72)m=	125.93	123.83	119.45	113.5	109.64	104.2	99.58	105.5	107.61	113.77	120.72	123.84	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	416.7	414.68	401.59	380.46	359.02	338.32	324.84	330.68	341.5	362.84	387.37	405.75	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)		
South	0.9x	0.77	x	6.9	x	46.75	x	0.5	x	0.8	=	89.42	(78)
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	6.9	x	76.57	x	0.5	x	0.8	=	146.45	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)

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South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	6.9	x	97.53	x	0.5	x	0.8	=	186.55	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	6.9	x	110.23	x	0.5	x	0.8	=	210.84	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	6.9	x	114.87	x	0.5	x	0.8	=	219.71	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	6.9	x	110.55	x	0.5	x	0.8	=	211.44	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	6.9	x	108.01	x	0.5	x	0.8	=	206.59	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	6.9	x	104.89	x	0.5	x	0.8	=	200.63	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	6.9	x	101.89	x	0.5	x	0.8	=	194.87	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	6.9	x	82.59	x	0.5	x	0.8	=	157.96	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	6.9	x	55.42	x	0.5	x	0.8	=	106	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	6.9	x	40.4	x	0.5	x	0.8	=	77.27	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)

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West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	164.06	273.48	359.33	422.01	452.71	440.98	428.65	406.82	381.09	298.15	195.39	141.14	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	580.77	688.16	760.91	802.47	811.73	779.3	753.49	737.5	722.59	660.98	582.76	546.88	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.93	0.85	0.7	0.51	0.37	0.39	0.59	0.87	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.38	20.55	20.74	20.89	20.97	21	21	21	20.99	20.89	20.6	20.33	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.81	0.65	0.45	0.3	0.33	0.53	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.42	19.67	19.92	20.12	20.21	20.23	20.24	20.24	20.23	20.13	19.74	19.35	(90)

fLA = Living area ÷ (4) =

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.8	20.02	20.25	20.43	20.52	20.54	20.54	20.54	20.54	20.43	20.08	19.74	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.8	20.02	20.25	20.43	20.52	20.54	20.54	20.54	20.54	20.43	20.08	19.74	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.82	0.67	0.48	0.33	0.35	0.56	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	573.19	664.13	698.63	659.54	540.34	372.49	248.08	260.61	401.36	554.65	563.71	541.79	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	976.18	952.04	865.52	725.88	555.17	373.97	248.19	260.77	405.21	619.04	817.45	978.49	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	299.83	193.47	124.17	47.77	11.04	0	0	0	0	47.91	182.69	324.9	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = (98)

Space heating requirement in kWh/m²/year

(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)
<i>The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.</i>			
Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		kWh/year	
Annual space heating requirement		1231.78	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1293.37	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2085.99	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2190.29	(310a)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	34.84	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		49.74	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	49.74	(331)
Energy for lighting (calculated in Appendix L)		335.67	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	= 809.11 (367)
Electrical energy for heat distribution	[(313) x	0.52	= 18.08 (372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)		= 827.19 (373)
CO2 associated with space heating (secondary)	(309) x	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	= 0 (375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		827.19 (376)
CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	= 25.81 (378)

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CO2 associated with electricity for lighting	(332))) x	0.52	=	174.21	(379)
Total CO2, kg/year	sum of (376)...(382) =			1027.21	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			13.36	(384)
El rating (section 14)				88.7	(385)

DRAFT

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-3-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	73.72 (1a) x	2.4 (2a) =	176.93 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.72 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.93 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)

Additional infiltration	[(9)-1]x0.1 =	0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)

If no draught lobby, enter 0.05, else enter 0	0 (13)

Percentage of windows and doors draught stripped	0 (14)

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 2			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 3			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 4			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 5			4.6	$\times 1/[1/(1.2)+0.04]$	5.27		
Walls Type1	41.25	15.64	25.61	0.18	4.61		
Walls Type2	4.81	2.1	2.71	0.18	0.49		
Total area of elements, m²			46.06				
Party wall			43.17	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 25.53 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.82 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 32.35 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=

29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

61.54	61.54	61.54	61.54	61.54	61.54	61.54	61.54	61.54	61.54	61.54	61.54

Average = Sum(39)_{1...12} /12=

61.54 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83

Average = Sum(40)_{1...12} /12=

0.83 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

2.33 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

89.61 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
98.57	94.98	91.4	87.82	84.23	80.65	80.65	84.23	87.82	91.4	94.98	98.57

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)
(44)m=

98.57	94.98	91.4	87.82	84.23	80.65	80.65	84.23	87.82	91.4	94.98	98.57

Total = Sum(44)_{1...12} = 1075.29 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

146.17	127.84	131.92	115.01	110.36	95.23	88.25	101.26	102.47	119.42	130.36	141.56

Total = Sum(45)_{1...12} = 1409.88 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

21.93	19.18	19.79	17.25	16.55	14.28	13.24	15.19	15.37	17.91	19.55	21.23

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03 (52)

Temperature factor from Table 2b

0.6 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03 (54)

Enter (50) or (54) in (55)

1.03 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.45	177.77	187.2	168.51	165.64	148.73	143.52	156.54	155.97	174.7	183.85	196.84

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=	201.45	177.77	187.2	168.51	165.64	148.73	143.52	156.54	155.97	174.7	183.85	196.84

Output from water heater (annual)_{1...12}

2060.72

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.82	82.45	88.09	81.04	80.92	74.46	73.56	77.89	76.87	83.93	86.14	91.29

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.35	16.3	13.25	10.03	7.5	6.33	6.84	8.89	11.94	15.16	17.69	18.86

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.82	207.95	202.57	191.12	176.65	163.06	153.98	151.84	157.22	168.68	183.14	196.74

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66

(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32

(71)

Water heating gains (Table 5)

(72)m=	124.76	122.69	118.4	112.55	108.76	103.42	98.88	104.69	106.76	112.81	119.64	122.7

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	406.93	404.94	392.22	371.7	350.9	330.8	317.69	323.42	333.91	354.64	378.47	396.29

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)

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South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)

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West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	161.2	273.58	370.43	450.44	495.29	487.26	471.65	439.12	398.42	301.43	192.93	138.04	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	568.13	678.52	762.64	822.13	846.2	818.06	789.34	762.55	732.33	656.07	571.4	534.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.93	0.82	0.66	0.48	0.34	0.37	0.57	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.37	20.55	20.75	20.91	20.98	21	21	21	20.99	20.89	20.6	20.32	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.91	0.79	0.61	0.42	0.28	0.31	0.51	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.39	19.65	19.92	20.12	20.21	20.22	20.22	20.22	20.22	20.11	19.72	19.32	(90)

fLA = Living area ÷ (4) =

0.4

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.79	20.01	20.25	20.44	20.52	20.53	20.53	20.53	20.53	20.43	20.07	19.72	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.79	20.01	20.25	20.44	20.52	20.53	20.53	20.53	20.53	20.43	20.07	19.72	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.8	0.63	0.45	0.31	0.33	0.54	0.83	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	560.2	652.85	692.54	654.58	531.52	364.06	242.03	254.28	392.36	544.31	551.6	529.01	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	953.02	930.05	846.33	709.99	542.52	365.09	242.1	254.41	395.63	604.77	798.21	955.16	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	292.26	186.28	114.42	39.89	8.18	0	0	0	0	44.98	177.56	317.06	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1180.63 (98)

Space heating requirement in kWh/m²/year

16.02 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
1180.63

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 1239.66 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2060.72

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2163.75 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] = 34.03 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

47.7 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) = 47.7 (331)

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Energy for lighting (calculated in Appendix L)

324.05 (332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 790.47 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 17.66 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 808.13 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		808.13 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 24.76 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 168.18 (379)
Total CO2, kg/year	sum of (376)...(382) =		1001.07 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		13.58 (384)
EI rating (section 14)			88.7 (385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-3-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	92.81 (1a)	2.4 (2a)	222.74 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.81 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	222.74 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			1.84	$\times 1/[1/(1.2)+0.04]$	2.11		
Windows Type 2			1.84	$\times 1/[1/(1.2)+0.04]$	2.11		
Windows Type 3			4.6	$\times 1/[1/(1.2)+0.04]$	5.27		
Windows Type 4			5.29	$\times 1/[1/(1.2)+0.04]$	6.06		
Windows Type 5			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Walls Type1	39.36	16.33	23.03	0.18	4.15		
Walls Type2	23.43	2.1	21.33	0.18	3.84		
Total area of elements, m²			62.79				
Party wall			43.2	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 29.2 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.35 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.55 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=

36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

74.3	74.3	74.3	74.3	74.3	74.3	74.3	74.3	74.3	74.3	74.3	74.3

Average = Sum(39)_{1...12} /12=

74.3 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8

Average = Sum(40)_{1...12} /12=

0.8 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

2.66 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

97.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
107.17	103.27	99.38	95.48	91.58	87.69	87.69	91.58	95.48	99.38	103.27	107.17

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)
(44)m=

107.17	103.27	99.38	95.48	91.58	87.69	87.69	91.58	95.48	99.38	103.27	107.17

Total = Sum(44)_{1...12} = 1169.14 (44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)
(45)m=

158.93	139	143.44	125.05	119.99	103.54	95.95	110.1	111.42	129.85	141.74	153.92

Total = Sum(45)_{1...12} = 1532.93 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

23.84	20.85	21.52	18.76	18	15.53	14.39	16.52	16.71	19.48	21.26	23.09

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03 (52)

Temperature factor from Table 2b

0.6 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03 (54)

Enter (50) or (54) in (55)

1.03 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	214.21	188.93	198.72	178.55	175.27	157.04	151.23	165.38	164.91	185.12	195.23	209.19

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=	214.21	188.93	198.72	178.55	175.27	157.04	151.23	165.38	164.91	185.12	195.23	209.19

Output from water heater (annual)_{1...12}

2183.77

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	97.07	86.16	91.91	84.38	84.12	77.22	76.12	80.83	79.84	87.4	89.92	95.4

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.91	19.46	15.82	11.98	8.96	7.56	8.17	10.62	14.25	18.1	21.12	22.52

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	244.15	246.69	240.3	226.71	209.55	193.43	182.66	180.12	186.51	200.1	217.26	233.38

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31

(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49

(71)

Water heating gains (Table 5)

(72)m=	130.47	128.22	123.54	117.19	113.06	107.25	102.32	108.64	110.89	117.47	124.89	128.22

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	459.46	457.29	442.6	418.81	394.51	371.18	356.08	362.32	374.58	398.6	426.2	447.06

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42

(74)

(74)

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North	0.9x	0.77	x	4.6	x	10.63	x	0.5	x	0.8	=	13.56	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.5	x	0.8	=	25.91	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	4.6	x	34.53	x	0.5	x	0.8	=	44.03	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.5	x	0.8	=	70.72	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.5	x	0.8	=	95.27	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.5	x	0.8	=	101.99	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.5	x	0.8	=	95.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.5	x	0.8	=	75.55	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.5	x	0.8	=	52.94	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.5	x	0.8	=	30.84	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.5	x	0.8	=	16.73	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.5	x	0.8	=	11.3	(74)
West	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(80)

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West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	68.23	132.37	220.45	333.22	423.85	441.92	417.35	347.25	259.5	157.25	84.75	56.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	527.69	589.67	663.05	752.03	818.36	813.1	773.42	709.57	634.08	555.85	510.96	503.44	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	1	1	0.99	0.94	0.79	0.58	0.42	0.48	0.76	0.97	1	1	

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.34	20.54	20.79	20.95	20.99	21	21	20.97	20.75	20.43	20.19	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.74	0.51	0.35	0.4	0.7	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.21	19.38	19.66	20.01	20.21	20.25	20.25	20.25	20.23	19.96	19.51	19.16	(90)

fLA = Living area ÷ (4) =

0.4

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.76	20.02	20.32	20.5	20.55	20.55	20.55	20.52	20.27	19.88	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.76	20.02	20.32	20.5	20.55	20.55	20.55	20.52	20.27	19.88	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.92	0.76	0.54	0.38	0.43	0.72	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	526.15	585.74	649.01	690.13	619.29	438.64	293.34	307.8	458.07	530.35	507.4	502.35	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1138.12	1104.28	1004.24	848.54	654.11	441.89	293.59	308.42	477.39	718.69	949.55	1142.33	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	455.31	348.46	264.29	114.05	25.9	0	0	0	0	140.12	318.34	476.14	(98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2142.62 (98)

Space heating requirement in kWh/m²/year

23.09 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2142.62

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 2249.75 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2183.77

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2292.96 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] = 45.43 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

60.06 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) = 60.06 (331)

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Energy for lighting (calculated in Appendix L)

386.9 (332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1055.08 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 23.58 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1078.66 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1078.66 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 31.17 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 200.8 (379)
Total CO2, kg/year	sum of (376)...(382) =		1310.63 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		14.12 (384)
EI rating (section 14)			87.26 (385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-3-08

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	73.39 (1a) x	2.4 (2a) =	176.14 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.39 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.14 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.2 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.2	= 2.52		(26)
Windows Type 1			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 2			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 3			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 4			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 5			6.9	x 1/[1/(1.2)+0.04]	= 7.9		(27)
Walls Type1	40.92	17.94	22.98	x 0.18	= 4.14		(29)
Walls Type2	21.61	2.1	19.51	x 0.18	= 3.51		(29)
Total area of elements, m²			62.53				(31)
Party wall			38.59	x 0	= 0		(32)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 30.71 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.08 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.79 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=

29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06	29.06

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

67.85	67.85	67.85	67.85	67.85	67.85	67.85	67.85	67.85	67.85	67.85	67.85

Average = Sum(39)_{1...12} / 12 =

67.85 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92

Average = Sum(40)_{1...12} / 12 =

0.92 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

2.33 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

89.43 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
98.37	94.8	91.22	87.64	84.07	80.49	80.49	84.07	87.64	91.22	94.8	98.37

Total = Sum(44)_{1...12} =

1073.18 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

145.89	127.59	131.67	114.79	110.14	95.04	88.07	101.06	102.27	119.19	130.1	141.28

Total = Sum(45)_{1...12} =

1407.11 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

21.88	19.14	19.75	17.22	16.52	14.26	13.21	15.16	15.34	17.88	19.52	21.19

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03 (52)

Temperature factor from Table 2b

0.6 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03 (54)

Enter (50) or (54) in (55)

1.03 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

201.16	177.52	186.94	168.28	165.42	148.54	143.35	156.34	155.77	174.46	183.6	196.56

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=

201.16	177.52	186.94	168.28	165.42	148.54	143.35	156.34	155.77	174.46	183.6	196.56

Output from water heater (annual)_{1...12}

2057.94

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=

92.73	82.37	88	80.96	80.84	74.4	73.51	77.83	76.8	83.85	86.05	91.2

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28	116.28

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

18.28	16.24	13.21	10	7.47	6.31	6.82	8.86	11.89	15.1	17.63	18.79

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

205.08	207.2	201.84	190.43	176.01	162.47	153.42	151.29	156.66	168.07	182.48	196.03

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63

(69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02	-93.02

(71)

Water heating gains (Table 5)

(72)m=

124.64	122.57	118.28	112.45	108.66	103.33	98.8	104.6	106.67	112.7	119.52	122.58

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

405.88	403.9	391.21	370.75	350.03	329.99	316.92	322.64	333.1	353.76	377.51	395.28

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)
North	0.9x	0.77	x	2.76	x	10.63	x	0.5	x	0.8	=	8.14	(74)

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North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	20.32	x	0.5	x	0.8	=	15.55	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	34.53	x	0.5	x	0.8	=	26.42	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	55.46	x	0.5	x	0.8	=	42.43	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	74.72	x	0.5	x	0.8	=	57.16	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	79.99	x	0.5	x	0.8	=	61.19	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	74.68	x	0.5	x	0.8	=	57.13	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	59.25	x	0.5	x	0.8	=	45.33	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	41.52	x	0.5	x	0.8	=	31.76	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	24.19	x	0.5	x	0.8	=	18.51	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	13.12	x	0.5	x	0.8	=	10.04	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
North	0.9x	0.77	x	2.76	x	8.86	x	0.5	x	0.8	=	6.78	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	6.9	x	19.64	x	0.5	x	0.8	=	37.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	6.9	x	38.42	x	0.5	x	0.8	=	73.49	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	6.9	x	63.27	x	0.5	x	0.8	=	121.02	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	6.9	x	92.28	x	0.5	x	0.8	=	176.5	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	6.9	x	113.09	x	0.5	x	0.8	=	216.31	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	6.9	x	115.77	x	0.5	x	0.8	=	221.43	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)

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West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	6.9	x	110.22	x	0.5	x	0.8	=	210.81	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	6.9	x	94.68	x	0.5	x	0.8	=	181.08	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	6.9	x	73.59	x	0.5	x	0.8	=	140.75	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	6.9	x	45.59	x	0.5	x	0.8	=	87.2	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	6.9	x	24.49	x	0.5	x	0.8	=	46.84	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	6.9	x	16.15	x	0.5	x	0.8	=	30.89	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	83.89	163.37	270.67	402.57	503.68	520.97	493.73	416.61	316.88	193.97	104.38	69.17	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	489.77	567.26	661.89	773.33	853.72	850.96	810.65	739.25	649.98	547.73	481.9	464.45	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.88	0.7	0.51	0.37	0.42	0.69	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.14	20.29	20.54	20.81	20.96	20.99	21	21	20.97	20.75	20.38	20.1	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.85	0.65	0.44	0.3	0.34	0.62	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19	19.22	19.58	19.94	20.11	20.14	20.15	20.15	20.13	19.86	19.35	18.94	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.45	19.65	19.96	20.29	20.45	20.48	20.49	20.49	20.47	20.22	19.76	19.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.45	19.65	19.96	20.29	20.45	20.48	20.49	20.49	20.47	20.22	19.76	19.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.86	0.67	0.47	0.33	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	486.77	558.99	632.49	662.78	571.57	396.98	263.56	276.83	418.71	504.25	475.21	462.33	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1028.2	1000.68	913.42	772.87	593.7	399.24	263.77	277.31	431.9	652.49	858.95	1031.35	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	402.82	296.81	209.01	79.27	16.47	0	0	0	0	110.3	276.29	423.35	(98)

Total per year (kWh/year) = Sum(98)_{...5,9...12} = 1814.33 (98)

Space heating requirement in kWh/m²/year

24.72 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
1814.33

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 1905.04 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2057.94

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2160.84 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] = 40.66 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

47.49 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) = 47.49 (331)

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Energy for lighting (calculated in Appendix L)

322.88

(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 944.33 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 21.1 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 965.44 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		965.44 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 24.65 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 167.57 (379)
Total CO2, kg/year	sum of (376)...(382) =		1157.66 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		15.77 (384)
El rating (section 14)			86.9 (385)

DRAFT

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-9-05

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	76.86 (1a) x	2.4 (2a) =	184.46 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76.86 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.46 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)					0 (9)
Additional infiltration					[(9)-1]x0.1 = 0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction					0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0					0 (12)
If no draught lobby, enter 0.05, else enter 0					0 (13)
Percentage of windows and doors draught stripped					0 (14)
Window infiltration				0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate				(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area					4 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)					0.2 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor				(21) = (18) x (20) =	0.17 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	1.2	2.52		
Windows Type 1			6.9	$\times 1/[1/(1.2)+0.04]$	7.9		
Windows Type 2			1.84	$\times 1/[1/(1.2)+0.04]$	2.11		
Windows Type 3			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Windows Type 4			2.76	$\times 1/[1/(1.2)+0.04]$	3.16		
Walls Type1	31.77	14.26	17.51	0.18	3.15		
Walls Type2	23.59	2.1	21.49	0.18	3.87		
Roof	6.11	0	6.11	0.11	0.67		
Total area of elements, m²			61.47				
Party wall			33.4	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 26.54 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.41 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.95 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=

30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44	30.44

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

66.39	66.39	66.39	66.39	66.39	66.39	66.39	66.39	66.39	66.39	66.39	66.39

Average = Sum(39)_{1...12} /12=

66.39 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86

Average = Sum(40)_{1...12} /12=

0.86 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.4 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

91.21 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
100.34	96.69	93.04	89.39	85.74	82.09	82.09	85.74	89.39	93.04	96.69	100.34

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)
(44)m=

100.34	96.69	93.04	89.39	85.74	82.09	82.09	85.74	89.39	93.04	96.69	100.34

Total = Sum(44)_{1...12} = 1094.57 (44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)
(45)m=

148.79	130.14	134.29	117.08	112.34	96.94	89.83	103.08	104.31	121.56	132.7	144.1

Total = Sum(45)_{1...12} = 1435.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

22.32	19.52	20.14	17.56	16.85	14.54	13.47	15.46	15.65	18.23	19.9	21.61

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03 (52)

Temperature factor from Table 2b

0.6 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03 (54)

Enter (50) or (54) in (55)

1.03 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	204.07	180.06	189.57	170.57	167.61	150.43	145.1	158.36	157.8	176.84	186.19	199.38

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0

(63)

Output from water heater

(64)m=	204.07	180.06	189.57	170.57	167.61	150.43	145.1	158.36	157.8	176.84	186.19	199.38

Output from water heater (annual)_{1...12}

2085.99

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.7	83.21	88.87	81.72	81.57	75.03	74.09	78.5	77.48	84.64	86.92	92.13

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03	120.03

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.01	16.88	13.73	10.39	7.77	6.56	7.09	9.21	12.37	15.7	18.33	19.54

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	212.75	214.96	209.4	197.55	182.6	168.55	159.16	156.96	162.52	174.36	189.31	203.37

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35	35	35	35	35	35	35	35	35	35	35	35

(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02	-96.02

(71)

Water heating gains (Table 5)

(72)m=	125.93	123.83	119.45	113.5	109.64	104.2	99.58	105.5	107.61	113.77	120.72	123.84

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	416.7	414.68	401.59	380.46	359.02	338.32	324.84	330.68	341.5	362.84	387.37	405.75

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	6.9	x	46.75	x	0.5	x	0.8	=	89.42
South	0.9x	0.77	x	1.84	x	46.75	x	0.5	x	0.8	=	23.85

(78)

(78)

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South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	6.9	x	76.57	x	0.5	x	0.8	=	146.45	(78)
South	0.9x	0.77	x	1.84	x	76.57	x	0.5	x	0.8	=	39.05	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	6.9	x	97.53	x	0.5	x	0.8	=	186.55	(78)
South	0.9x	0.77	x	1.84	x	97.53	x	0.5	x	0.8	=	49.75	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	6.9	x	110.23	x	0.5	x	0.8	=	210.84	(78)
South	0.9x	0.77	x	1.84	x	110.23	x	0.5	x	0.8	=	56.22	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	6.9	x	114.87	x	0.5	x	0.8	=	219.71	(78)
South	0.9x	0.77	x	1.84	x	114.87	x	0.5	x	0.8	=	58.59	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	6.9	x	110.55	x	0.5	x	0.8	=	211.44	(78)
South	0.9x	0.77	x	1.84	x	110.55	x	0.5	x	0.8	=	56.38	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	6.9	x	108.01	x	0.5	x	0.8	=	206.59	(78)
South	0.9x	0.77	x	1.84	x	108.01	x	0.5	x	0.8	=	55.09	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	6.9	x	104.89	x	0.5	x	0.8	=	200.63	(78)
South	0.9x	0.77	x	1.84	x	104.89	x	0.5	x	0.8	=	53.5	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	6.9	x	101.89	x	0.5	x	0.8	=	194.87	(78)
South	0.9x	0.77	x	1.84	x	101.89	x	0.5	x	0.8	=	51.97	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	6.9	x	82.59	x	0.5	x	0.8	=	157.96	(78)
South	0.9x	0.77	x	1.84	x	82.59	x	0.5	x	0.8	=	42.12	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	6.9	x	55.42	x	0.5	x	0.8	=	106	(78)
South	0.9x	0.77	x	1.84	x	55.42	x	0.5	x	0.8	=	28.27	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	6.9	x	40.4	x	0.5	x	0.8	=	77.27	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.5	x	0.8	=	20.6	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	164.06	273.48	359.33	422.01	452.71	440.98	428.65	406.82	381.09	298.15	195.39	141.14	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	580.77	688.16	760.91	802.47	811.73	779.3	753.49	737.5	722.59	660.98	582.76	546.88	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.86	0.72	0.54	0.39	0.41	0.62	0.88	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.31	20.49	20.68	20.86	20.96	20.99	21	21	20.99	20.86	20.55	20.26	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.83	0.67	0.47	0.32	0.34	0.55	0.85	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.29	19.54	19.81	20.04	20.16	20.2	20.2	20.2	20.19	20.05	19.63	19.22	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.7	19.92	20.16	20.37	20.48	20.51	20.52	20.52	20.51	20.38	19.99	19.64	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.7	19.92	20.16	20.37	20.48	20.51	20.52	20.52	20.51	20.38	19.99	19.64	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.93	0.84	0.69	0.5	0.34	0.37	0.58	0.86	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	573.78	666.6	705.62	674.43	561.11	390.16	259.95	273.09	419.31	565.88	565.62	542.14	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1022.34	997.2	906.99	761.46	583.06	392.66	260.14	273.41	425.46	649.03	856.01	1024.74	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	333.73	222.16	149.81	62.66	16.33	0	0	0	0	61.86	209.08	359.06	

Total per year (kWh/year) = Sum(98)1...5,9...12 =

1414.7 (98)

Space heating requirement in kWh/m²/year

18.41 (99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

1414.7

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

1485.43 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2085.99

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2190.29 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

36.76 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

49.74 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

49.74 (331)

Energy for lighting (calculated in Appendix L)

335.67 (332)

12b. CO2 Emissions – Community heating scheme

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%)

If there is CHP using two fuels repeat (363) to (366) for the second fuel

93 (367a)

CO2 associated with heat source 1

[(307b)+(310b)] x 100 ÷ (367b) x

0.22

=

853.72 (367)

Electrical energy for heat distribution

[(313) x

0.52

=

19.08 (372)

Total CO2 associated with community systems

(363)...(366) + (368)...(372)

=

872.79 (373)

CO2 associated with space heating (secondary)

(309) x

0

=

0 (374)

CO2 associated with water from immersion heater or instantaneous heater

(312) x

0.22

=

0 (375)

Total CO2 associated with space and water heating

(373) + (374) + (375) =

872.79 (376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	=	25.81	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	174.21	(379)
Total CO2, kg/year	sum of (376)...(382) =			1072.82	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			13.96	(384)
El rating (section 14)				88.2	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-9-06

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	73.72 (1a) x	2.4 (2a) =	176.93 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.72 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	176.93 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)

Additional infiltration [(9)-1]x0.1 = (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 (12)

If no draught lobby, enter 0.05, else enter 0 (13)

Percentage of windows and doors draught stripped (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered (19)

Shelter factor (20) = 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.2	= 2.52		(26)
Windows Type 1			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 2			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 3			4.6	x 1/[1/(1.2)+0.04]	= 5.27		(27)
Windows Type 4			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Windows Type 5			2.76	x 1/[1/(1.2)+0.04]	= 3.16		(27)
Walls Type1	41.25	15.64	25.61	x 0.18	= 4.61		(29)
Walls Type2	4.81	2.1	2.71	x 0.18	= 0.49		(29)
Roof	70.23	0	70.23	x 0.11	= 7.73		(30)
Total area of elements, m²			116.29				(31)
Party wall			43.17	x 0	= 0		(32)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 33.25 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.91 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 48.16 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=	77.36	77.36	77.36	77.36	77.36	77.36	77.36	77.36	77.36	77.36	77.36	77.36	
Average = Sum(39) _{1...12} / 12 =												77.36	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	
Average = Sum(40) _{1...12} / 12 =												1.05	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

2.33 (42)

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

89.61 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$	98.57	94.98	91.4	87.82	84.23	80.65	80.65	84.23	87.82	91.4	94.98	98.57	
(44)m=	98.57	94.98	91.4	87.82	84.23	80.65	80.65	84.23	87.82	91.4	94.98	98.57	
Total = Sum(44) _{1...12} =												1075.29	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.17	127.84	131.92	115.01	110.36	95.23	88.25	101.26	102.47	119.42	130.36	141.56	
Total = Sum(45) _{1...12} =												1409.88	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.93	19.18	19.79	17.25	16.55	14.28	13.24	15.19	15.37	17.91	19.55	21.23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03 (52)

Temperature factor from Table 2b

0.6 (53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03 (54)

Enter (50) or (54) in (55)

1.03 (55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

201.45	177.77	187.2	168.51	165.64	148.73	143.52	156.54	155.97	174.7	183.85	196.84

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

201.45	177.77	187.2	168.51	165.64	148.73	143.52	156.54	155.97	174.7	183.85	196.84

Output from water heater (annual) ^{1...12}	2060.72

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

92.82	82.45	88.09	81.04	80.92	74.46	73.56	77.89	76.87	83.93	86.14	91.29

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65	116.65

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

18.35	16.3	13.25	10.03	7.5	6.33	6.84	8.89	11.94	15.16	17.69	18.86

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

205.82	207.95	202.57	191.12	176.65	163.06	153.98	151.84	157.22	168.68	183.14	196.74

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66	34.66

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32	-93.32

 (71)

Water heating gains (Table 5)

(72)m=

124.76	122.69	118.4	112.55	108.76	103.42	98.88	104.69	106.76	112.81	119.64	122.7

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

406.93	404.94	392.22	371.7	350.9	330.8	317.69	323.42	333.91	354.64	378.47	396.29

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	4.6	x	46.75	x	0.5	x	0.8	=	59.61	(78)
South	0.9x	0.77	x	2.76	x	46.75	x	0.5	x	0.8	=	35.77	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.5	x	0.8	=	97.63	(78)
South	0.9x	0.77	x	2.76	x	76.57	x	0.5	x	0.8	=	58.58	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.5	x	0.8	=	124.37	(78)
South	0.9x	0.77	x	2.76	x	97.53	x	0.5	x	0.8	=	74.62	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.5	x	0.8	=	140.56	(78)
South	0.9x	0.77	x	2.76	x	110.23	x	0.5	x	0.8	=	84.34	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.5	x	0.8	=	146.47	(78)
South	0.9x	0.77	x	2.76	x	114.87	x	0.5	x	0.8	=	87.88	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	4.6	x	110.55	x	0.5	x	0.8	=	140.96	(78)
South	0.9x	0.77	x	2.76	x	110.55	x	0.5	x	0.8	=	84.58	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.5	x	0.8	=	137.73	(78)
South	0.9x	0.77	x	2.76	x	108.01	x	0.5	x	0.8	=	82.64	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.5	x	0.8	=	133.75	(78)
South	0.9x	0.77	x	2.76	x	104.89	x	0.5	x	0.8	=	80.25	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.5	x	0.8	=	129.92	(78)
South	0.9x	0.77	x	2.76	x	101.89	x	0.5	x	0.8	=	77.95	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.5	x	0.8	=	105.31	(78)
South	0.9x	0.77	x	2.76	x	82.59	x	0.5	x	0.8	=	63.18	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.5	x	0.8	=	70.66	(78)
South	0.9x	0.77	x	2.76	x	55.42	x	0.5	x	0.8	=	42.4	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.5	x	0.8	=	51.51	(78)
South	0.9x	0.77	x	2.76	x	40.4	x	0.5	x	0.8	=	30.91	(78)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)

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West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	161.2	273.58	370.43	450.44	495.29	487.26	471.65	439.12	398.42	301.43	192.93	138.04	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	568.13	678.52	762.64	822.13	846.2	818.06	789.34	762.55	732.33	656.07	571.4	534.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.89	0.77	0.59	0.43	0.46	0.69	0.92	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.25	20.49	20.74	20.91	20.98	21	21	20.96	20.74	20.33	20	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.86	0.71	0.51	0.34	0.37	0.61	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.8	19.08	19.42	19.75	19.96	20.03	20.04	20.04	20.01	19.76	19.2	18.72	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.3	19.55	19.85	20.15	20.34	20.41	20.42	20.42	20.39	20.15	19.66	19.23	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.3	19.55	19.85	20.15	20.34	20.41	20.42	20.42	20.39	20.15	19.66	19.23	(93)

8. Space heating requirement

Set $T_{i,m}$ to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, h_m :

(94)m=	0.99	0.97	0.94	0.87	0.73	0.54	0.37	0.41	0.64	0.89	0.98	0.99	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	561.99	660.89	717.5	712.73	618.15	441.49	294.89	309.76	467.52	583.57	557.62	530.01	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	1160.47	1132.95	1032.58	870.06	668.42	449.6	295.8	311.21	486.84	738.72	971.25	1163.06	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	445.27	317.22	234.42	113.28	37.4	0	0	0	0	115.43	297.82	470.98	

Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$ 2031.83 (98)

Space heating requirement in $kWh/m^2/year$

27.56 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2031.83

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 2133.43 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2060.72

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2163.75 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 42.97 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

47.7 (330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	47.7	(331)
Energy for lighting (calculated in Appendix L)		324.05	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 998.05 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 22.3 (372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$		= 1020.36 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1020.36 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 24.76 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 168.18 (379)
Total CO2, kg/year	sum of (376) ... (382) =		1213.3 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		16.46 (384)
EI rating (section 14)			86.31 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.12

Property Address: b2-9-07

Address : Preliminary SAP

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	92.81 (1a) x	2.4 (2a) =	222.74 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.81 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	222.74 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) (9)

Additional infiltration [(9)-1]x0.1 = (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 (12)

If no draught lobby, enter 0.05, else enter 0 (13)

Percentage of windows and doors draught stripped (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered (19)

Shelter factor (20) = 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.2	= 2.52		(26)
Windows Type 1			1.84	x 1/[1/(1.2) + 0.04]	= 2.11		(27)
Windows Type 2			2.76	x 1/[1/(1.2) + 0.04]	= 3.16		(27)
Windows Type 3			1.84	x 1/[1/(1.2) + 0.04]	= 2.11		(27)
Windows Type 4			4.6	x 1/[1/(1.2) + 0.04]	= 5.27		(27)
Windows Type 5			5.29	x 1/[1/(1.2) + 0.04]	= 6.06		(27)
Walls Type1	39.36	16.33	23.03	x 0.18	= 4.15		(29)
Walls Type2	23.43	2.1	21.33	x 0.18	= 3.84		(29)
Roof	51.52	0	51.52	x 0.11	= 5.67		(30)
Total area of elements, m²			114.31				(31)
Party wall			43.2	x 0	= 0		(32)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 34.87 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.79 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 49.66 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

86.42	86.42	86.42	86.42	86.42	86.42	86.42	86.42	86.42	86.42	86.42	86.42

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

86.42

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

0.93

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.66

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

97.43

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
107.17	103.27	99.38	95.48	91.58	87.69	87.69	91.58	95.48	99.38	103.27	107.17

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1169.14

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

158.93	139	143.44	125.05	119.99	103.54	95.95	110.1	111.42	129.85	141.74	153.92

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1532.93

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

23.84	20.85	21.52	18.76	18	15.53	14.39	16.52	16.71	19.48	21.26	23.09

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(56)

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

214.21	188.93	198.72	178.55	175.27	157.04	151.23	165.38	164.91	185.12	195.23	209.19

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (63)

Output from water heater

(64)m=

214.21	188.93	198.72	178.55	175.27	157.04	151.23	165.38	164.91	185.12	195.23	209.19

Output from water heater (annual) ^{1...12}	2183.77

 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

(65)m=

97.07	86.16	91.91	84.38	84.12	77.22	76.12	80.83	79.84	87.4	89.92	95.4

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11	133.11

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

21.91	19.46	15.82	11.98	8.96	7.56	8.17	10.62	14.25	18.1	21.12	22.52

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

244.15	246.69	240.3	226.71	209.55	193.43	182.66	180.12	186.51	200.1	217.26	233.38

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31	36.31

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49	-106.49

 (71)

Water heating gains (Table 5)

(72)m=

130.47	128.22	123.54	117.19	113.06	107.25	102.32	108.64	110.89	117.47	124.89	128.22

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

459.46	457.29	442.6	418.81	394.51	371.18	356.08	362.32	374.58	398.6	426.2	447.06

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	1.84	x	10.63	x	0.5	x	0.8	=	5.42	(74)
North	0.9x	0.77	x	4.6	x	10.63	x	0.5	x	0.8	=	13.56	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	1.84	x	20.32	x	0.5	x	0.8	=	10.36	(74)
North	0.9x	0.77	x	4.6	x	20.32	x	0.5	x	0.8	=	25.91	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	1.84	x	34.53	x	0.5	x	0.8	=	17.61	(74)
North	0.9x	0.77	x	4.6	x	34.53	x	0.5	x	0.8	=	44.03	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	1.84	x	55.46	x	0.5	x	0.8	=	28.29	(74)
North	0.9x	0.77	x	4.6	x	55.46	x	0.5	x	0.8	=	70.72	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	1.84	x	74.72	x	0.5	x	0.8	=	38.11	(74)
North	0.9x	0.77	x	4.6	x	74.72	x	0.5	x	0.8	=	95.27	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	1.84	x	79.99	x	0.5	x	0.8	=	40.8	(74)
North	0.9x	0.77	x	4.6	x	79.99	x	0.5	x	0.8	=	101.99	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	1.84	x	74.68	x	0.5	x	0.8	=	38.09	(74)
North	0.9x	0.77	x	4.6	x	74.68	x	0.5	x	0.8	=	95.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	1.84	x	59.25	x	0.5	x	0.8	=	30.22	(74)
North	0.9x	0.77	x	4.6	x	59.25	x	0.5	x	0.8	=	75.55	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	1.84	x	41.52	x	0.5	x	0.8	=	21.18	(74)
North	0.9x	0.77	x	4.6	x	41.52	x	0.5	x	0.8	=	52.94	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	1.84	x	24.19	x	0.5	x	0.8	=	12.34	(74)
North	0.9x	0.77	x	4.6	x	24.19	x	0.5	x	0.8	=	30.84	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	1.84	x	13.12	x	0.5	x	0.8	=	6.69	(74)
North	0.9x	0.77	x	4.6	x	13.12	x	0.5	x	0.8	=	16.73	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	1.84	x	8.86	x	0.5	x	0.8	=	4.52	(74)
North	0.9x	0.77	x	4.6	x	8.86	x	0.5	x	0.8	=	11.3	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.5	x	0.8	=	15.03	(80)
West	0.9x	0.77	x	5.29	x	19.64	x	0.5	x	0.8	=	28.8	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.5	x	0.8	=	29.39	(80)
West	0.9x	0.77	x	5.29	x	38.42	x	0.5	x	0.8	=	56.34	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.5	x	0.8	=	48.41	(80)

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West	0.9x	0.77	x	5.29	x	63.27	x	0.5	x	0.8	=	92.78	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.5	x	0.8	=	70.6	(80)
West	0.9x	0.77	x	5.29	x	92.28	x	0.5	x	0.8	=	135.32	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.5	x	0.8	=	86.52	(80)
West	0.9x	0.77	x	5.29	x	113.09	x	0.5	x	0.8	=	165.84	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.5	x	0.8	=	88.57	(80)
West	0.9x	0.77	x	5.29	x	115.77	x	0.5	x	0.8	=	169.76	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.5	x	0.8	=	84.32	(80)
West	0.9x	0.77	x	5.29	x	110.22	x	0.5	x	0.8	=	161.62	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.5	x	0.8	=	72.43	(80)
West	0.9x	0.77	x	5.29	x	94.68	x	0.5	x	0.8	=	138.83	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.5	x	0.8	=	56.3	(80)
West	0.9x	0.77	x	5.29	x	73.59	x	0.5	x	0.8	=	107.91	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.5	x	0.8	=	34.88	(80)
West	0.9x	0.77	x	5.29	x	45.59	x	0.5	x	0.8	=	66.85	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.5	x	0.8	=	18.74	(80)
West	0.9x	0.77	x	5.29	x	24.49	x	0.5	x	0.8	=	35.91	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.5	x	0.8	=	12.36	(80)
West	0.9x	0.77	x	5.29	x	16.15	x	0.5	x	0.8	=	23.68	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	68.23	132.37	220.45	333.22	423.85	441.92	417.35	347.25	259.5	157.25	84.75	56.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	527.69	589.67	663.05	752.03	818.36	813.1	773.42	709.57	634.08	555.85	510.96	503.44	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.85	0.66	0.49	0.55	0.83	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.03	20.15	20.37	20.66	20.88	20.98	21	20.99	20.93	20.63	20.27	20	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.14	20.14	20.14	20.14	20.14	20.14	20.14	20.14	20.14	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.94	0.8	0.58	0.39	0.45	0.76	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.84	19.01	19.33	19.73	20.03	20.13	20.14	20.14	20.08	19.7	19.19	18.79	(90)

fLA = Living area ÷ (4) =

0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.32	19.47	19.75	20.1	20.37	20.47	20.48	20.48	20.42	20.07	19.62	19.27	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.32	19.47	19.75	20.1	20.37	20.47	20.48	20.48	20.42	20.07	19.62	19.27	(93)

8. Space heating requirement

Set $T_{i,m}$ to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, h_m :

(94)m=	1	0.99	0.98	0.94	0.82	0.61	0.43	0.49	0.79	0.97	0.99	1	(94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	526.24	586.27	652.11	707.19	668	495.33	334.24	349.9	498.08	536.86	507.89	502.38	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=	1297.82	1259.06	1144.71	968.11	749.38	507.15	335.54	352.65	546.05	818.28	1081.94	1302.67	(97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	574.06	452.11	366.5	187.87	60.54	0	0	0	0	209.37	413.32	595.41	

Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$ 2859.18 (98)

Space heating requirement in $kWh/m^2/year$

30.81 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year
2859.18

Space heat from Community boilers

(98) x (304a) x (305) x (306) = 3002.14 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

2183.77

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) = 2292.96 (310a)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$ 52.95 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$ 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

60.06 (330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	60.06	(331)
Energy for lighting (calculated in Appendix L)		386.9	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		93 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1229.83 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 27.48 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1257.31 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1257.31 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 31.17 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 200.8 (379)
Total CO2, kg/year	sum of (376)...(382) =		1489.28 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		16.05 (384)
EI rating (section 14)			85.52 (385)